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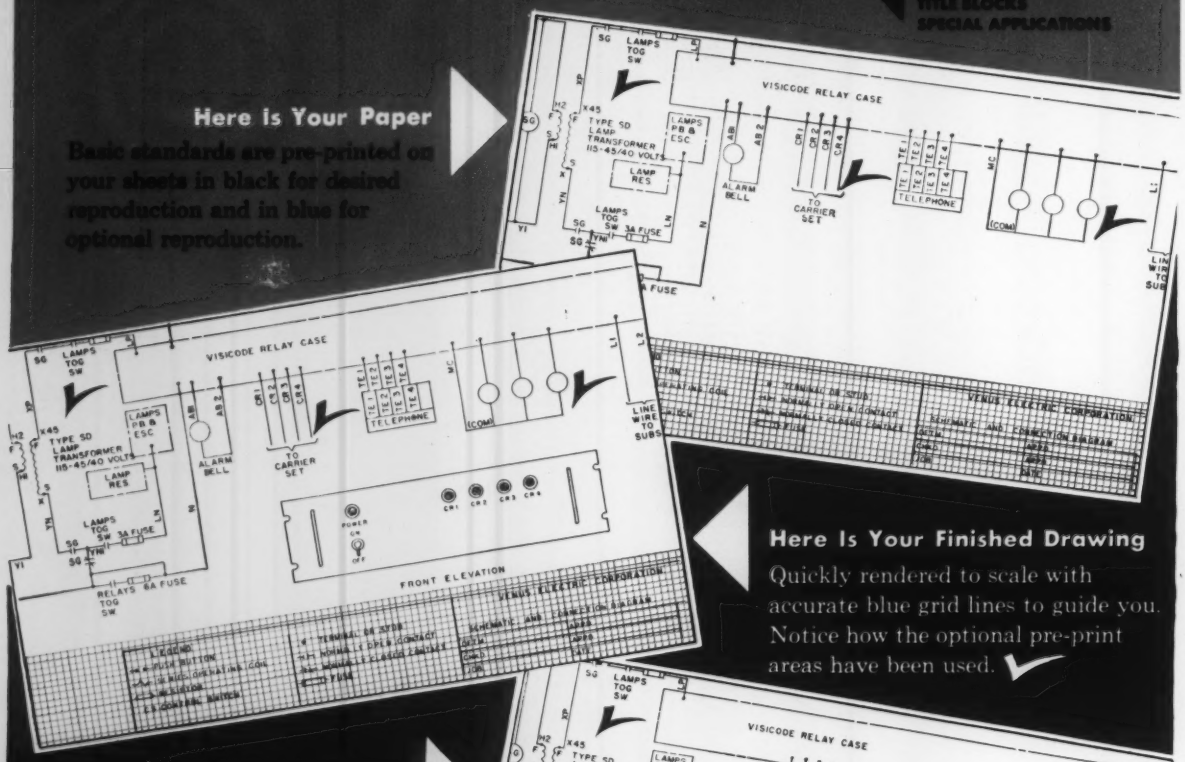


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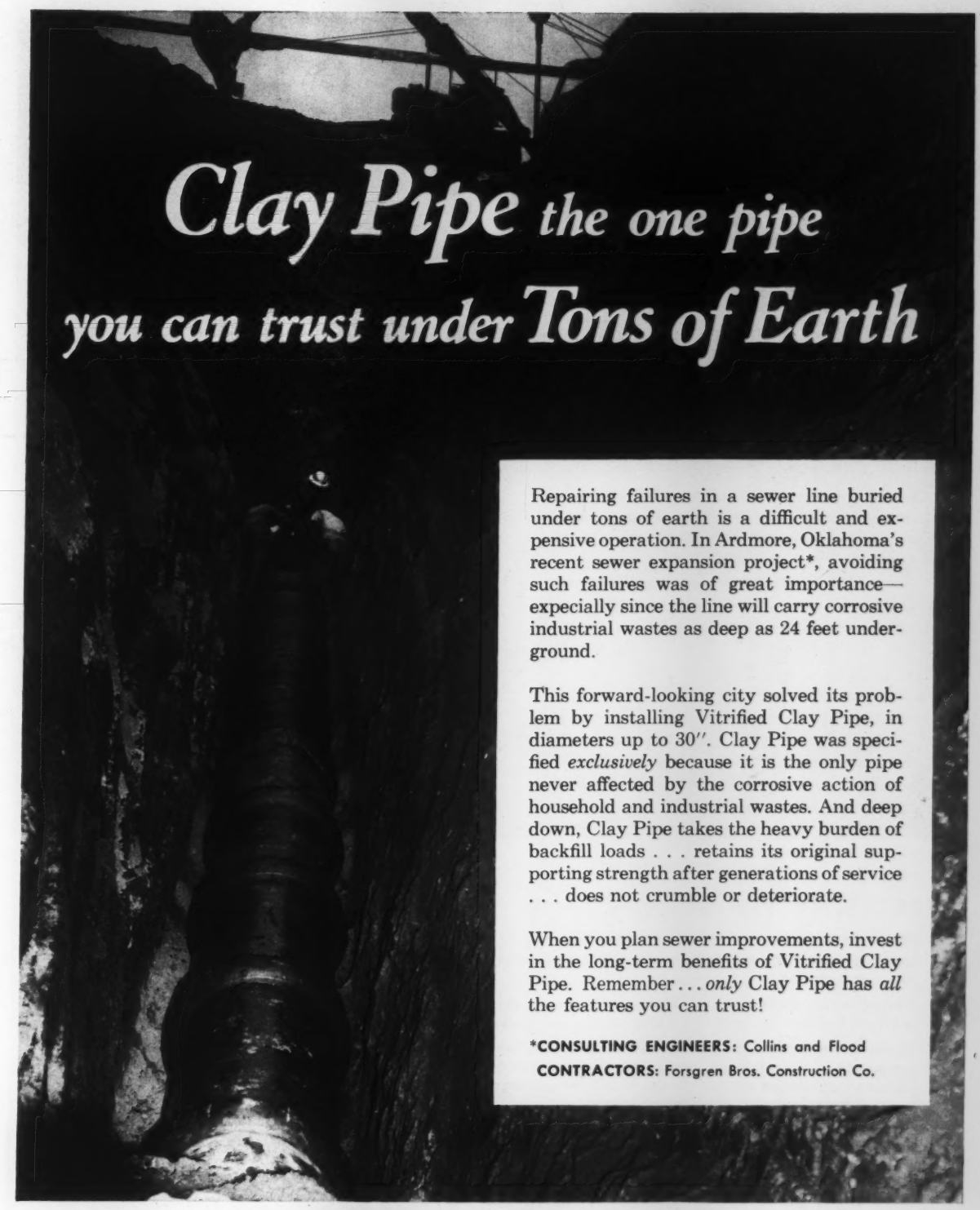

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# CIVIL ENGINEERING

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VOL. 29 • NO. 7

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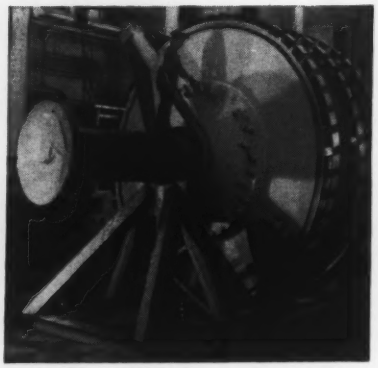

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to here?
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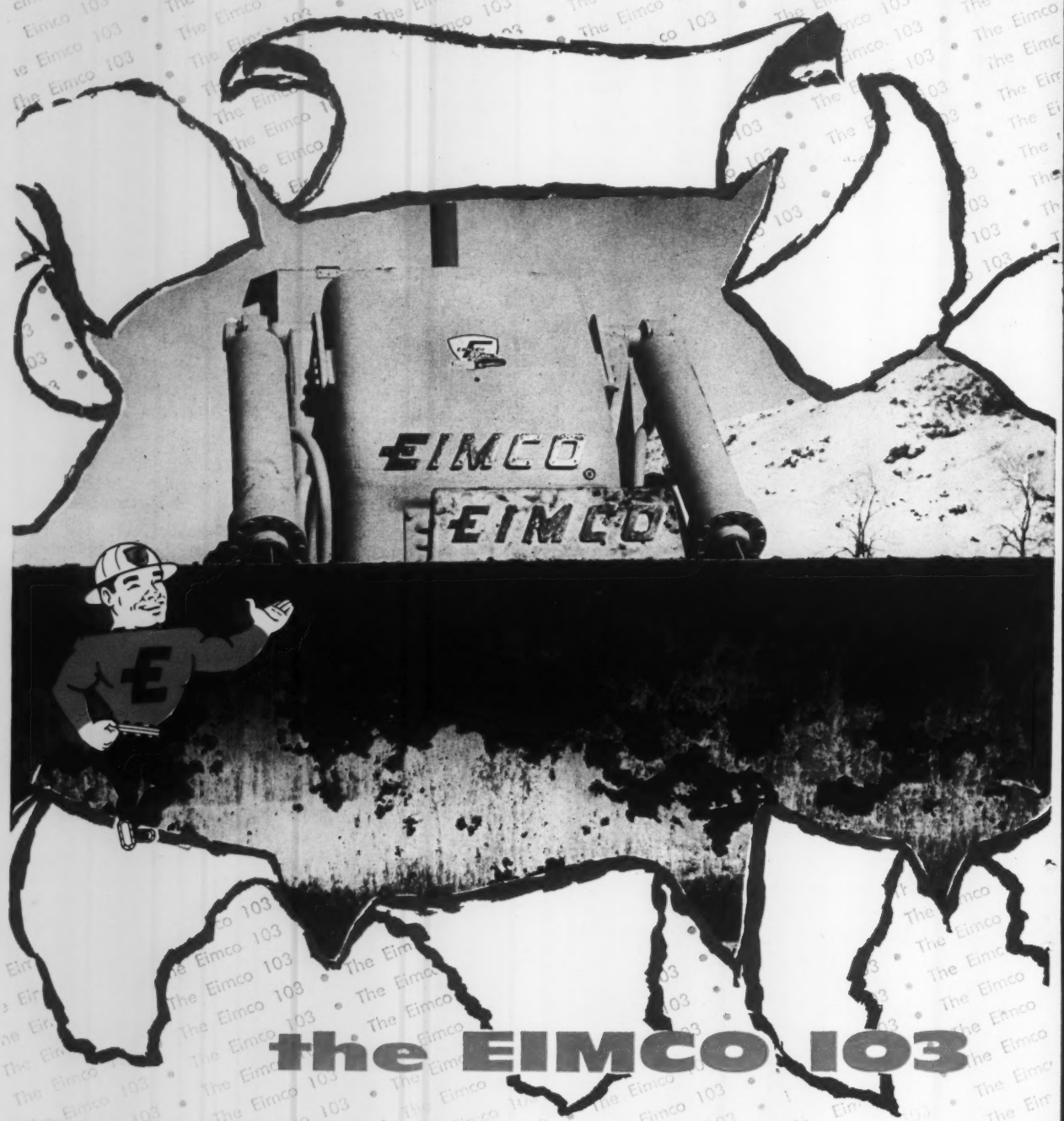


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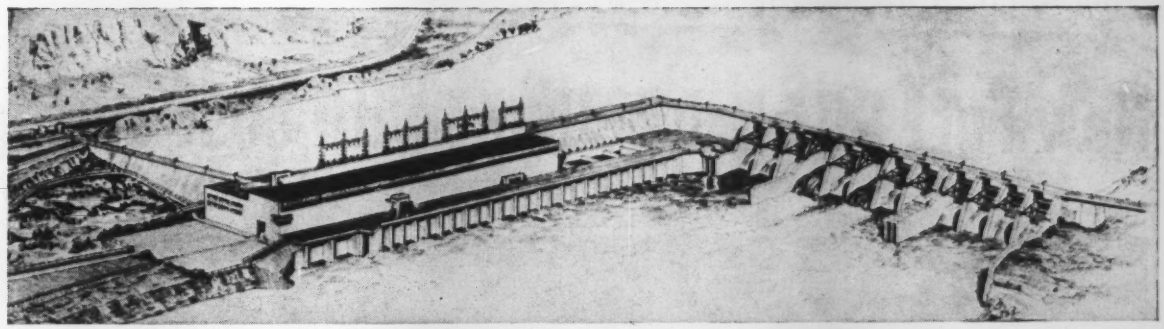
Designer: Bridge Section, Fort Worth District, Texas Highway Department
Contractors: Austin Bridge Company, Dallas, and Worth Construction Company, Fort Worth



Rocky Reach Hydroelectric Project, under construction on the Columbia River by Public Utility District No. 1 of Chelan County, Washington. Stone & Webster Engineering Corp. are Engineers and Supervisors of Construction. The installation is downstream from Chief Joseph Power Project, where six 100,000 HP vertical Allis-Chalmers Francis units are installed.

Homologous models for Rocky Reach were tested in the York Works Hydraulic Laboratory under controlled conditions that duplicate those in protoype field installations.

# ROCKY REACH TO USE ALLIS-CHALMERS KAPLAN TURBINES

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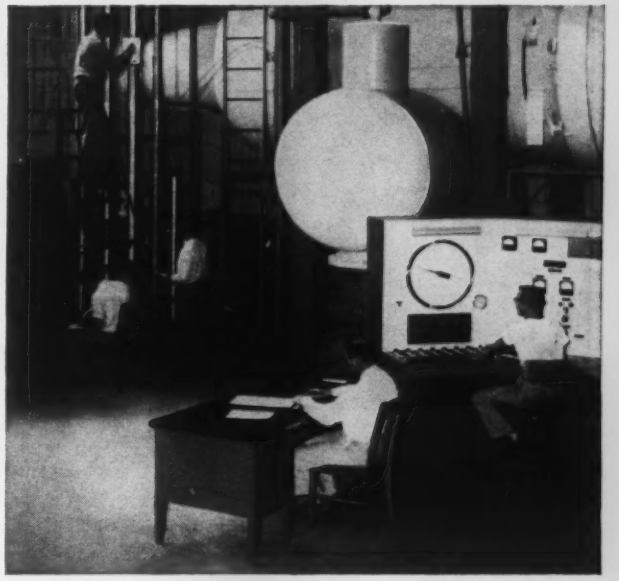

Rocky Reach Hydroelectric Project, scheduled to generate electricity in 1961, will be powered by seven Allis-Chalmers Kaplan turbines. These 280-inch units are each rated at 140,000 HP under a 92-foot head, with maximum expected capacity exceeding 160,000 HP under a 98-foot head. This new high-capacity design, with greatly improved cavitation characteristics, was developed by Allis-Chalmers engineers at the York Works and tested in the high head test stand there.

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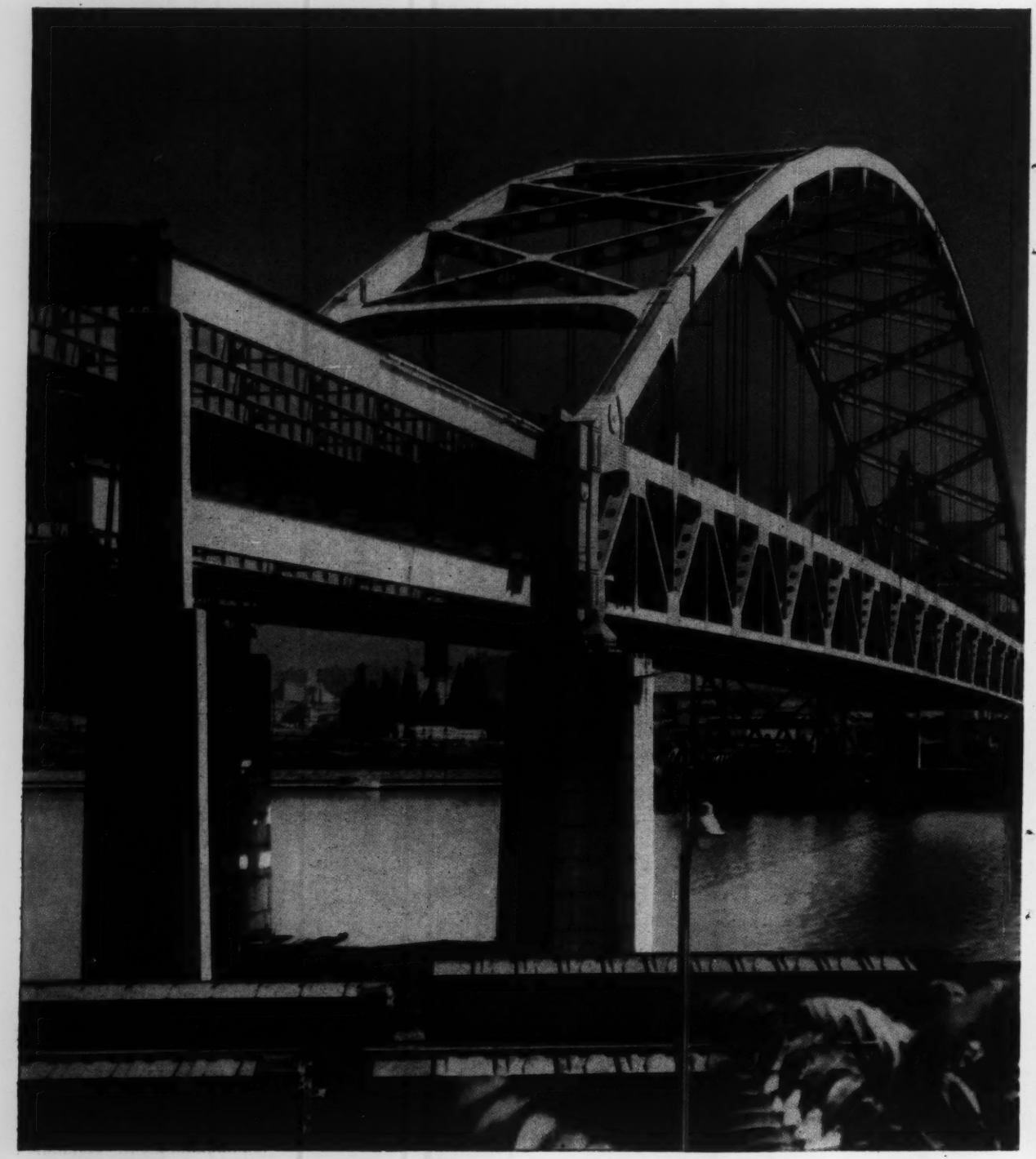
# New Fort Pitt Bridge built with cost-saving



# USS MAN-TEN High-Strength Steel

Under the shiny new paint on Pittsburgh's Fort Pitt Bridge is a steel with a reputation—USS MAN-TEN High-Strength Steel. More than two-thirds of the 8,000 tons of steel in the 750-foot span is USS MAN-TEN brand—a steel that delivers high strength (50,000 psi min. yield point) with economy.

The bridge is regarded by engineers as the most unusual structure in the entire Penn-Lincoln Parkway System. It is a double-deck, tied-arch design and will carry four lanes of one-way traffic on each level.

For the heavily stressed members, high-strength steel answered the problem of getting higher allowable stress per dollar by avoiding unnecessary weight. USS MAN-TEN Steel was used in all chords, most diagonals and verticals, and all portal members including end floor beams. The roadways are supported by 112 pre-stressed USS Tiger Brand suspender ropes, each 3¼" in diameter with an ultimate strength of 475 tons.

**Other USS High-Strength Steels available** for construction include USS TRI-TEN High-Strength Low-Alloy Steel which, like USS MAN-TEN, has a minimum yield point of 50,000 psi and which is particularly recommended for welded structures. USS COR-TEN High-Strength Low-Alloy Steel also has a 50,000 psi minimum yield point and, because of its outstanding resistance to atmospheric corrosion and superior paint adherence qualities, is a "natural" for riveted structures located in corrosive areas. Where an extra high yield strength steel is needed, we offer USS "T-1" Constructional Alloy Steel which combines weldability and toughness with 100,000 psi minimum yield strength.

For complete information on any of these steels, write United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

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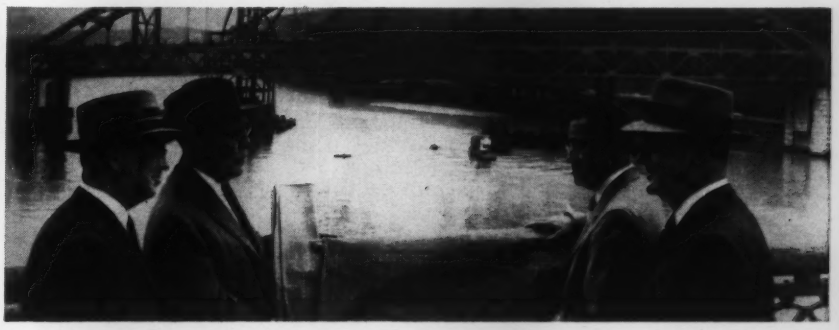
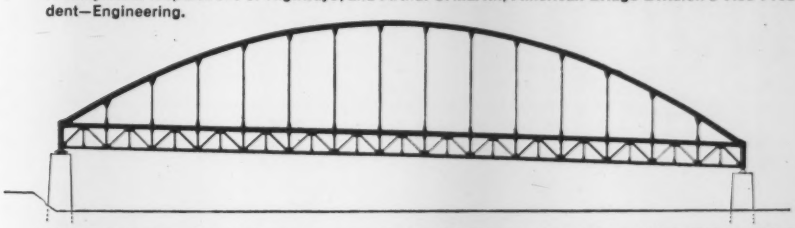


**Some of the men who played major roles** in making the new Fort Pitt Bridge at Pittsburgh a reality: left to right are Alan A. Porter, American Bridge Division's Vice President—Construction; George S. Richardson, consulting engineer, designer of the bridge; Leonard J. Curran, District Engineer, Pennsylvania Department of Highways; and Arthur S. Marvin, American Bridge Division's Vice President—Engineering.



**Where high-strength steel saves money.** Profile of bridge showing parts made of USS MAN-TEN Steel in heavy lines. For these members, MAN-TEN Steel's high strength and relatively low cost made it the economical steel to use.

# New BROS Roller... See how you can benefit by these 15 improved features

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**A sound investment in Plant Security and a Landmark of company progress . . .**

*Big Brother* to the Watersphere®, the Horton Waterspheroid is engineered to provide dependable gravity pressure for plant water and/or sprinkler reserves in capacities up to 500,000 gallons.

Whether your water requirements are large or small, a graceful Horton structure can complement both the utility and the beauty of your modern plant by:

(1) Saving up to 60% in fire insurance premiums.

(2) Providing the promotional benefits of *skyline advertising.*

Write our nearest office for descriptive literature on the Watersphere or the Waterspheroid.

*250,000-gallon Waterspheroid graces the skyline above Automatic Electric Company plant at Northlake, Illinois. Provides reserves for sprinkler system and plant water. Furnished through The Austin Company.*

## Chicago Bridge & Iron Company

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New Orleans • New York • Philadelphia • Pittsburgh • Salt Lake City
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SUBSIDIARIES:
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# *Marconi in Telecommunications*

**The post and telegraph authorities of more than 80 countries use Marconi equipment**

**MARCONI** **COMPLETE COMMUNICATION SYSTEMS**
*SURVEYED · PLANNED · INSTALLED · MAINTAINED*

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MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED, CHELMSFORD, ESSEX, ENGLAND

M.1

# BRASILIA

Not since the city of Washington was carved from the swamps of Virginia has such a magnificent dream taken shape. Rising from the red dust and wilderness of the Central Plateau, this new capital exemplifies the fresh spirit of Brazil in action.

In an atmosphere reminiscent of our own country's frontier days, Raymond engineers and Raymond-trained local crews are racing the calendar to complete the city for the 1960 Presidential election.

Our work includes the foundations and steel superstructures for eleven Ministerial Buildings; the twin towered, 28 story Congresso Building; the hydroelectric station, and construction of an earth dam which will create a 25-mile lake—focal point of the city.

Helping to build the newest city in the world is, perhaps, the most dramatic example of our international construction activities. May we help in planning and executing your overseas construction?

*Write or call our Foreign Department*

**140 CEDAR STREET, NEW YORK 6, N. Y.**

*Branch offices in the principal cities of the United States. Subsidiaries in Canada, Central and South America and other countries around the world.*

RAYMOND INTERNATIONAL INC.

**FOUNDATIONS FOR THE STRUCTURES OF AMERICA . . . COMPLETE CONSTRUCTION SERVICES ABROAD**

"There are several reasons why I prefer to design plant buildings with steel frames. First, because you can adapt structural steel to virtually all architectural forms. It lends itself to attractive designs, inside and out. Second, because steel-framed buildings are so easy to expand; and their interiors are just as easy to re-design. Third, steel framing makes long spans possible; there are few columns to get in the way of machinery and equipment."

"Schools framed with structural steel make a lot of sense to an engineer. Steel is strong. Its behavior under stress is predictable; you can calculate its ability to support loads precisely, and in advance. There's no guesswork. Steel is stable and uniform, too. It remains in its original form. You always know what you're getting. In combination with other non-combustible materials, steel-framed schools greatly reduce fire hazards."

# Their reasons differ, but they all agree ...

***ONE MORE REASON** why steel framing makes sense: there's an ample supply of the fabricated structural shapes you need—when you need them.*

"Just recently, I supervised the construction of a new bank building. The plans called for a steel frame. The prefabricated structural shapes arrived at the site—on schedule—ready to be put into their proper place. Every member, column, and beam was a finished product. The steel went up fast—during some pretty nasty weather, too. Because the steel was placed well ahead of them, the other trades were able to get started early and keep moving."

"As the owner of a four-story parking garage, I'm naturally interested in costs. I've found my steel-framed building very easy to keep up. Where the steel is enclosed, I know it will last indefinitely. Where it's exposed, an occasional coat of paint keeps it as good as new. And, of course, steel won't shrink, warp, sag or rot. First cost was just as attractive, thanks to the quick construction of the steel frame. It went up in a matter of days."

# ... STEEL FRAMING MAKES SENSE

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

*Export distributor: Bethlehem Steel Export Corporation*

**BETHLEHEM STEEL**

BETHLEHEM STEEL

# NEWS OF MEMBERS

**Jon D. Anderson** has assumed new duties as deputy director of the New York State Office of Atomic Development, which was created by the Legislature this year on recommendation of Governor Rockefeller. Its function will be to advise the Governor and the Legislature on ways in which atomic energy development in the state can be fostered and encouraged. From 1950 until recently Mr. Anderson was manager of the Schenectady Naval Reactors Operations Office for the U. S. Atomic Energy Commission.

**Charles S. Heidel,** deputy state engineer for Montana, was awarded honorary membership in the Montana Society of Engineers during the society's recent 72nd annual meeting in Butte. Mr. Heidel is a veteran member of ASCE and was the first president of the Montana Section.

**Joe J. Rady,** a professional engineer in Texas for thirty-seven years, has been named "Engineer of the Year for 1958" by the Fort Worth Chapter of the Texas Society of Professional Engineers. A consultant on water and other municipal projects for more than a hundred Texas cities and towns, he now heads the firm of Joe J. Rady and Company, consulting engineers of Fort Worth.

**Donald O. Covault** recently received his Ph.D. degree from Purdue University where he has been employed for the past three years as a research engineer on the Joint Highway Research Project. In September 1958, Dr. Covault accepted the position of associate professor in the School of Civil Engineering at the Georgia Institute of Technology.

**Raymond D. Mindlin,** professor of civil engineering at Columbia University, has been appointed a research adviser to the National Aeronautics and Space Administration and will serve on the Agency's new Research Advisory Committee on Structural Dynamics. The committee is one of several new groups created to assist NASA in the formulation of national programs in aeronautical and space research. In 1946, Dr. Mindlin received the Medal for Merit from President Truman for his work in the development of the radio proximity fuse.

**George K. Leonard** will retire on July 31 as chief engineer of the Tennessee Valley Authority, Knoxville. Mr. Leonard joined the TVA in 1933 shortly after Congress passed the TVA Act, and was promoted to chief construction engineer in 1950 and to his present position in 1956. Seven large steam generating stations were constructed under Mr. Leonard's direction in the period 1950 to 1956, in response to the nation's need for vast power expansion.

**Alfred G. Rayner,** consulting engineer of Baton Rouge, La., has been named president of the Gulf Institute of Consulting Engineers. Organized in 1950, the Institute is a professional organization, covering the four-state area of Arkansas, Louisiana, Mississippi, and Alabama. Other officers include **T. Edward Ernst,** first vice president, and **B. M. Dornblatt,** second vice president.

**Fred S. Childs,** consulting engineer in the New York office of Bogert & Childs, recently announced his retirement. The firm will operate in the future under the name of Clinton Bogert Engineers and will continue to maintain offices in New York, N. Y., Hackensack, N. J., and South Norwalk, Conn.

**Arthur Chiu,** assistant professor in the Department of Civil Engineering at the University of Hawaii in Honolulu, has been made an associate professor. Professor Chiu is a former secretary of the Hawaii Section.


Specify S&L "OXIGEST" SEWAGE TREATMENT PLANT

FACTORY-BUILT TREATMENT PLANT FOR SMALL SUB-DIVISIONS

The Smith & Loveless "Oxigest" is a low-cost, factory-built sewage treatment plant for small sub-divisions, schools, motels and factories. It has been carefully engineered for dependable treatment without requiring a skilled operator. Built of the finest materials, the "Oxigest" will provide a permanent plant with minimum annual maintenance.

This complete factory-built unit is available in 27 standard sizes to cover a wide range of applications. It is easily and quickly installed after delivery to the job site on special Smith & Loveless trucks.

**Write today for free data manual containing design notes, selection charts, dimension drawings and specifications. Write Department 80**

**By the makers of America's finest factory-built sewage lift stations.** 3A

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**At a special ceremony of the Delaware River Port Authority, Honorary Members, Frank M. Masters (left), owner of Modjeski and Masters, Harrisburg, Pa., and Othmar H. Ammann (right), partner in the firm, Ammann and Whitney, New York, N. Y., receive stainless steel plaques from Port Authority Chairman James V. Baney, in recognition of their joint effort in the construction of the Walt Whitman Bridge, which connects Philadelphia, and Gloucester City, N. J.**

**Lynn S. Beedle,** research professor and chairman of the Structural Metals Division in the Fritz Engineering Laboratory at Lehigh University, Bethlehem, Pa., received the American Iron and Steel Institute's Regional Technical Meeting Award for the best paper in the field of research, at the Institute's 67th general meeting held in New York in May. The paper is entitled "Plastic Design of Steel Structures."

**Walt Riley,** consulting engineer of Phoenix, Ariz., was recently granted a patent by the U. S. Patent Office on his method of controlling vibrations in pipeline bridges.

**Earle Cassidy,** formerly senior civil engineer for the Salt River Power District at Phoenix, Ariz., has recently become general manager of the Valley Engineering Inspection Company, Inc., of Phoenix, a firm specializing in construction inspection and material testing.

**Robert H. Schmidt,** until now facilities engineer for the Area Development Committee (ADC), Akron, Ohio, has been promoted to assistant executive director. Before joining the ADC staff in 1955, he did considerable work on the Akron Expressway.

**T. Z. Chastain** and **T. A. Tindel** have formed Chastain & Tindel, Inc., new Atlanta consulting structural engineering concern, in a merger of two firms. Mr. Chastain since 1954 has operated a company bearing his name. **I. E. Morris,** board chairman of Morris and Tindel, will serve as structural consultant and board chairman of the new organization.

**Peter B. Heidema,** who is in the New England Division office of the Corps of Engineers, Waltham, Mass., is working as soils engineer on the International Passamaquoddy Tidal Power Survey.

**Harry E. Jordan,** secretary of the American Water Works Association in New York, who this fall will round out 56 years service in the water utility business, has made known his plans to retire on September 1. Mr. Jordan took over as the association's first fulltime secretary in 1936. **Raymond J. Faust,** executive assistant secretary, has been named to succeed Mr. Jordan. Mr. Faust was chief of the water supply section of the Michigan Department of Health when he resigned to join the association staff in New York in 1951.

**Celso Augustus Carbonell** was recently promoted to president of Sika Panama, S. A., in charge of the firm's operation in eighteen countries. Prior to his promotion, Mr. Carbonell was vice president and general manager of Sika in Panama. In 1951, when only 37 years old, he served as Minister of Public Works, the youngest minister of state in the history of the Panama Republic.

**Robert A. Monroe,** chief design engineer of the Tennessee Valley Authority, retired May 31, after more than twenty-two years of service with TVA. During this time, he was successively assistant chief water control planning engineer, assistant chief engineer, and for the past fourteen years chief design engineer. Mr. Monroe served for several years as secretary-treasurer of the San Francisco Section.

**John B. Okkerse,** formerly head of plant engineering at the Peoria, Ill., and Milwaukee, Wis., divisions of the Pabst Brewing Company, has been appointed plant engineering manager in the new Lockheed Electronics and Avionics Division (LEAD). Mr. Okkerse has been employed in various plant engineering management capacities during ten years with the Pabst Brewing Company.

**E. Robert Baumann,** professor of civil engineering at Iowa State College, has been granted a leave of absence to spend the 1959-1960 academic year in England on a National Science Foundation Science Faculty Fellowship. Dr. Baumann's interests are in sanitary engineering, and he will pursue postdoctoral studies in this area as well as in microbiology and biochemistry at Durham, King's College, where he has been accorded the status of visiting professor. During his absence, the program in sanitary engineering at Iowa State will be directed by **Harold E. Babbitt,** professor emeritus at the University of Illinois, who has been appointed visiting professor at Iowa State.

**Mansell L. MacLean,** president of MacLean-Grove & Company, Inc., of New York City, recently received an honorary Doctor of Civil Laws degree from his alma mater, Acadia University, at Wolfville, Nova Scotia. The MacLean-Grove organization is currently at work on a tunnel under the Rhine River at Dusseldorf, Germany, which will be the first underwater crossing of that stream. Mr. MacLean is the new president of The Moles.

**Jay S. Grumbling** has joined the staff of Metcalf & Eddy, consulting engineers of Boston, Mass., as a research engineer to investigate sludge digestion control. Previously he was associate editor of *Water & Sewage Works* and *Industrial Wastes* magazines.

**Daniel O. Cargill,** supervising civil engineer of bridges for the Rhode Island State Department of Highways, Providence, has taken over the post as chief engineer. Since 1935, Mr. Cargill has been bridge engineer in the State Department of Public Works. Recent major bridge projects completed under his supervision are the Sakonnet River Bridge, the Providence River Bridge, and the Pawtucket River Bridge.

*(Continued on page 25)*


STUMBLING HAZARD ELIMINATED

Spilled materials on a solid walkway caused workmen to stumble and turn ankles. Installation of 80% open Irving Mesh Grating allowed materials to fall through and minimized the hazard.

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*For Safe, Strong, Slip-Proof Stair Treads Specify*

**IRVING "VIZABLEDG" TREADS**

★

*Manufacturers of Riveted, Pressure-Locked, and Welded Gratings of Steel, Aluminum and other metals.*

**"A FITTING GRATING FOR EVERY PURPOSE"**

**IRVICO**

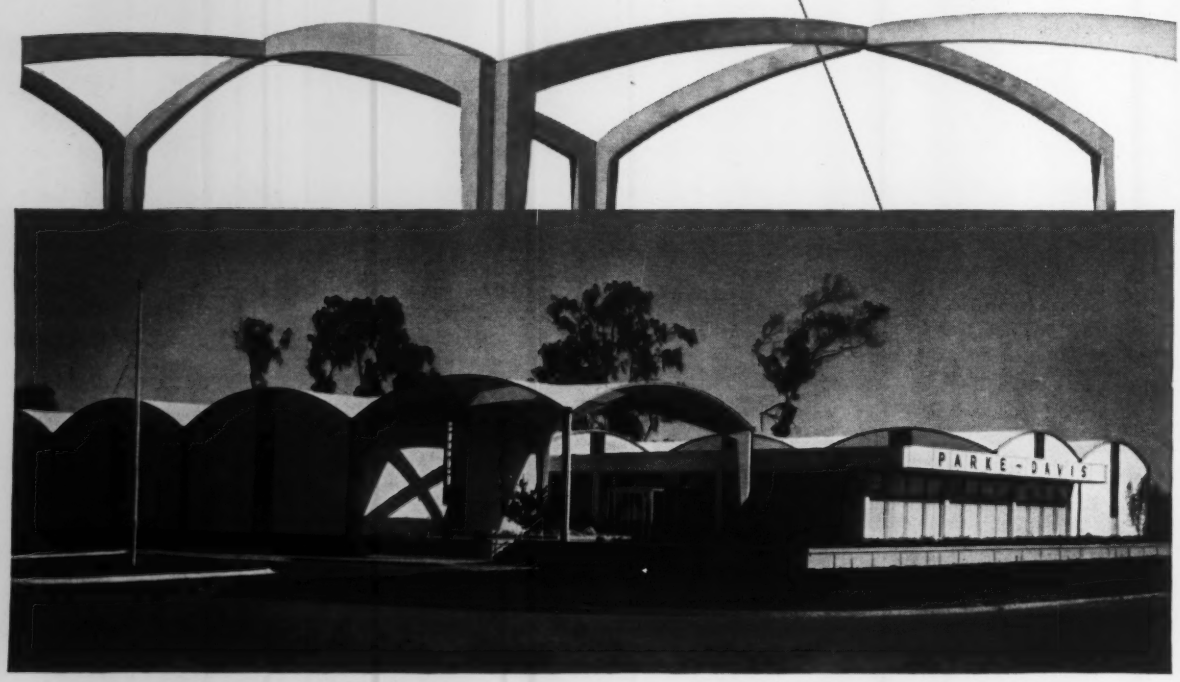
**IRVING SUBWAY GRATING CO., Inc.**

*Originators of the Grating Industry*

**Offices and Plants at**
**5008 27th St., LONG ISLAND CITY 1, N. Y.**
**1000 10th St., OAKLAND 23, CALIFORNIA**

Parke-Davis building
at Menlo Park...

# jaunty "showcase" assembled from just 3 basic shapes in precast concrete




Beauty is good public relations, agreed officials of Parke, Davis & Company in planning this combination office and warehouse in a restricted industrial area in Menlo Park, Calif. To achieve this beauty, and fill practical needs as well, concrete was chosen for the whole job.

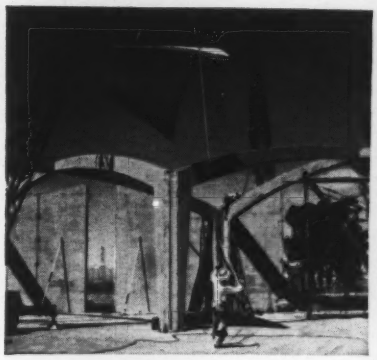
Shell-roof sections, L-shaped bents and wall panels were all precast, quickly and easily assembled on the job site. The results: a graceful, pleasing silhouette; the wide-open, fire-resistant interior specified; and a clean, modern look that suits a maker of pharmaceutical products.

*Architects: Minoru Yamasaki & Assoc., Birmingham, Mich. Associate Architects: Knorr-Elliot Assoc., San Francisco, Calif. Structural Engineers: Amman & Whitney, New York City.*

FOR STRUCTURES... MODERN **concrete**

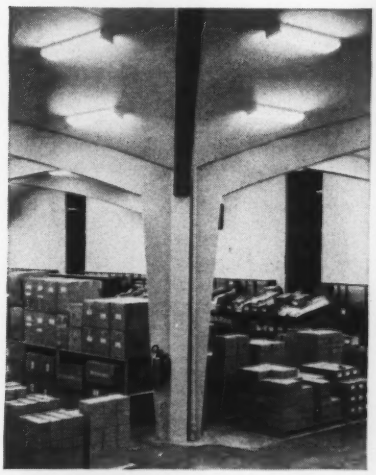
**PORTLAND CEMENT ASSOCIATION**

*A national organization to improve and extend the uses of concrete*



**Concrete shell roofs are money-savers for wide spans**

Thinner by far than an eggshell in thickness to span ratio, concrete shells give big material savings, low cost. Domes, barrels, folded plates, hyperbolic paraboloids are all shell forms that easily achieve large, unobstructed floor areas. Shells can be pierced for skylights, support heavy machinery suspended from them.



**Precast concrete units cut on-the-job building time**

For the Parke-Davis job, bents were stack-cast, locked together diagonally to form 40-ft. square bays. Lightweight concrete was used for the prestressed wall panels and for the shells. Multiple use was made of all forms.

**For free literature** *on shell construction (distributed only in U.S. and Canada) write to Portland Cement Association, Dept. A7-13, 33 West Grand Ave., Chicago 10, Illinois.*

## News of Members

*(Continued from page 23)*

**Howard S. Morse** has retired as chairman of the board of the Indianapolis Water Company after a thirty-four year association with the utility. He is an Honorary Member of ASCE. **Lewis S. Finch,** vice president and chief engineer, was elected to the Board of Directors of the company. Mr. Finch is one of three men who will decide on the sites for five federal plants designed to turn sea water into fresh water.

**Frederick H. Fox,** retiring professor and chairman of the Tulane University Department of Civil Engineering, New Orleans, La., was honored recently for his contributions and service to engineering education with the establishment of two new awards for engineer students—the Frederick H. Fox achievement and activity awards. A member of the Tulane engineering faculty since 1921, Professor Fox retired June 30.

**James R. Fraser** has been appointed director of engineering for the Theo. Hamm Brewing Company of St. Paul, Minn. In his new position he will be in charge of engineering at the Hamm plants in St. Paul, San Francisco, and Los Angeles. Previously he was vice president of engineering and construction firm of H. K. Ferguson.

**Edwin A. Fairbairn** and **Albert Givan,** respectively chief engineer for Sacramento and consulting engineer for the Sacramento Municipal Utility District, were honored recently by the Engineering Council of Sacramento Valley. Mr. Fairbairn was named Engineer of the Year 1959 and Mr. Givan was cited for his 62 years in the engineering field, 55 of them in the Sacramento Valley. Mr. Givan was the first president of the Sacramento Section of ASCE and first chief and general manager of the Sacramento Municipal Utility District.

**Robert W. Russell, Jr.,** has been elected to membership on the Board of Directors of the Maryland Highways Contractors Association, Inc., a statewide trade association of road and bridge contractors. Since 1943, Mr. Russell has been a partner in the firm of T. Edgie Russell, general contractors, and now is in active management of the firm.

**Horace P. Ramey,** retired chief engineer, and **Lawrence B. Barker,** retired assistant chief engineer, were among the retired veterans of the Greater Chicago Metropolitan Sanitary District honored at a recent luncheon by local, state, and national engineering and architectural societies. Mr. Ramey, with 52 years of service, led. Mr. Barker totaled 50 years of service.

**Howard L. White** has been made chief sales engineer of Armco Drainage & Metal Products, Inc., Middletown, Ohio. Mr. White was assistant professor of civil engineering and mathematics at Rose Polytechnic Institute for seven years prior to joining Armco Drainage in 1945 as a sales engineer. He became senior sales engineer in 1956.

**J. Philip Murphy,** formerly vice president and general manager of Judson Pacific-Murphy Division of Yuba Consolidated Industries, Inc., has been appointed vice president of Operations for the Structural and Reinforcing Bar Divisions of Yuba. Mr. Murphy will be responsible for coordinating all manufacturing activities related to fabricated structural and reinforcing steel. **Richard A. Murphy,** plant manager at Judson Pacific has taken over as vice president and general manager.

**John R. Clifton,** Colonel, Corps of Engineers, has been made district engineer at Honolulu, Hawaii. Since 1956 he has been assigned to the Army Ballistic Missile Agency and Army Ordnance Missile Command at the Redstone Arsenal in Alabama— first, as chief in the Facilities Division in the Engineer Office, and more recently as deputy chief, Engineer Office.

**Clarence H. Ax,** president of the Clarence H. Ax Construction Company of St. Louis, Mo., has just been elected president of the Engineers' Club of St. Louis, the third oldest Engineering group in the country, having been founded in 1868. For many years Mr. Ax has served on municipal committees, including the Executive Committee for the City of St. Louis $110,000,000 Bond Issue in 1955, and the chairmanship of the Bridges and Viaducts Committee for 1955 Bond Issue. Mr. Ax is a past-president of the St. Louis Section.

**Theodore A. Polansky,** long-time manager of the Gulf Concrete Pipe Company of Houston, Tex., recently retired. He reports the return of an ASCE pin which he lost twenty years ago near the State Highway Building in Austin, Tex. He now has two pins, but will give special care to the "lost" one.

**David J. Engel** is a new addition to the staff of Bernard Johnson & Associates, Houston (Tex.) consulting engineers. Mr. Engel, who will assume duties as chief structural engineer, recently became design engineer with Walter Kidde Engineers, Inc., of Cleveland, Tenn. He spent several years each with Metallic Building Company and Lockwood, Andrews and Newnam.

*(Continued on page 102)*

## $9,000,000 worth of bridges at Forest City and Mobridge, S. D.

**Designers:** Bridge Division of the South Dakota Department of Highways; Basic design by Bridge Engineer, K. R. Scurr. Final design and details by Missouri River Bridge Section of the Bridge Division, consisting of Roy W. Johnson, Chief Designer, and Structural Designers, Allen Fladeboe and Elek Kirchner.

**Resident Engineer:** K. O. Long, for foundations

**Substructure Contractor:** Massman Construction Co., Kansas City, Mo.

**Superstructure Contractor:** John F. Beasley Co., Chicago, Muskogee, Dallas

**Superstructure Steel Fabricator:**
Vincennes Steel Division of Industrial Enterprises, Inc., Vincennes, Ind.

**Girder Spans, Mobridge Bridge:**
Mississippi Valley Structural Steel Co.

# Biggest bridges between the Mississippi and the West Coast built solidly on USS Steel H-Piles

## Bridges span South Dakota's Oahe Reservoir—cost less than estimated

THESE TWO BRIDGES at Forest City and Mobridge are hailed as the largest single engineering and construction projects ever carried on in South Dakota, with the exception of Oahe and Ft. Randall dams. The bridges are larger than any between the Mississippi River and the West Coast.

The Forest City Bridge is 4,583 feet long and the 26-foot roadway is 165 feet above the Missouri River bed. The total cost is approximately $4,715,000.

The Mobridge structure is 5,059 feet long, with a 26-foot roadway 140 feet above the river bed. The approximate cost is $4,471,000.

Both bridges were constructed at costs substantially lower than original estimates. A major factor contributing to maximum economy was an advance purchase by the state of about 5,500 tons of USS Steel H-Piles. The immediate availability of these pilings at the sites had a considerable influence on the bidding for both projects.

At the Forest City site, the 14-inch, 102-lb. USS H-Piles were driven to a maximum depth of 140 feet into Pierre shale using a steam hammer with 30,000 foot-pounds of energy. At the Mobridge site, the maximum length of piling is about 115 feet.

### USS Steel H-Piles proved structurally and economically sound

The use of 5,500 tons of USS Steel H-Piles on these projects is further proof of their ability to provide a secure means of supporting foundations in unstable materials. They are readily handled in the field by ordinary equipment, are easy to splice, eliminate jetting, and withstand rough handling.

The great capacity of USS H-Piles for high unit loads, both vertical and horizontal, means fewer piles and fewer driving operations for a given load.

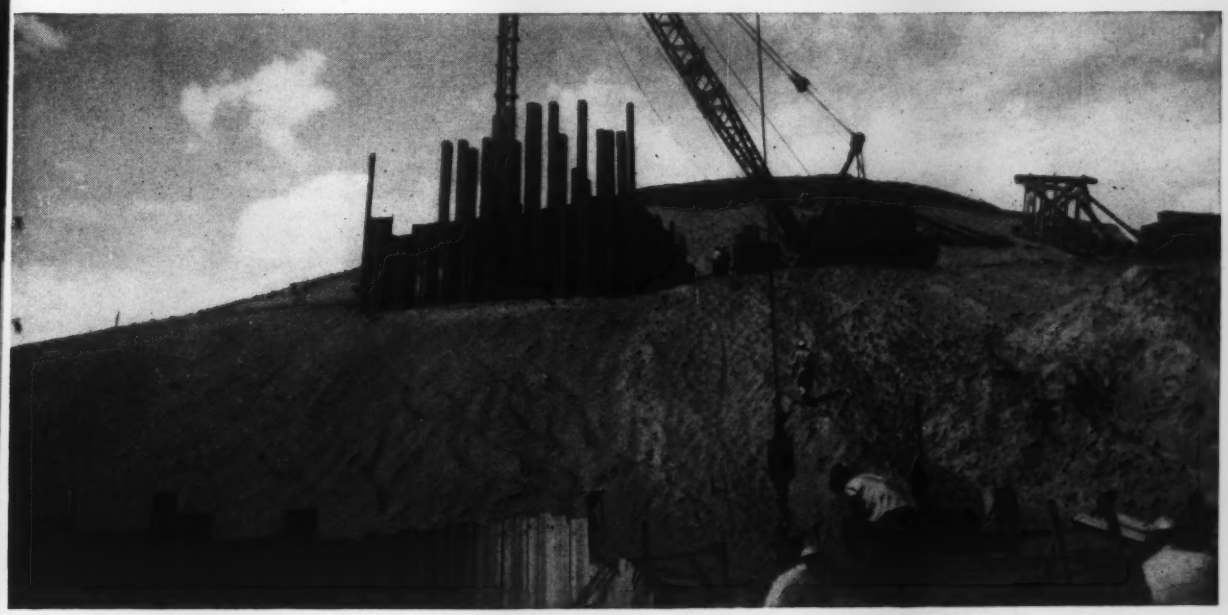
For more detailed information about the lasting safety and economy of USS Steel H-Piles for every type of foundation job, contact our nearest sales office.

*USS is a registered trademark*

United States Steel Corporation—Pittsburgh
Columbia-Geneva Steel—San Francisco
Tennessee Coal & Iron—Fairfield, Alabama
United States Steel Export Company

**United States Steel**

**Mobridge and Forest City Bridges** are similar in design and together take more than 8 thousand tons of fabricated steel and 5,500 tons of USS H-Piles.



FLOWAY

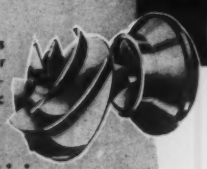
formerly SMITHway

# Helping the Jets Fly!

## In Arctic cold or tropical heat FloWay delivers the split-second performance the jets demand.

## RUGGED!

**IMPELLERS . . .**
Closed or semi-open impellers available — for volatile or hydrocarbon fluids. Composition altered to suit the specific condition.



**LINESHAFTS . . .**
Product-lubricated construction, utilizing high grade stainless steel for bearings, shafts, and couplings.

**SHAFT SEALS . . .**
Product lubricated construction. Fitted with conventional stuffing box or mechanical type seals. Seals are available to accomodate pressures from 0 to 500 PSI and temperatures from —55°F to 250°F.

**PUMP SUCTION DESIGNS**
For wet or dry pit installations. Now available are new low-suction bells for shallow submergence — no vortexing and minimum sump surging. For dry-pit operations, threaded or flanged suction connections may be used with variety of strainers.

Rugged dependability under a variety of the most exacting conditions . . that's one reason the U.S. Air Force chooses FloWay jet fuel pumps.

Industry, too, has pumping requirements that demand total dependability. You'll find it in FloWay's complete range of industrial pumps — from 15 GPM to 4,000 GPM. Experienced designing, precision manufacturing and rigid inspection are your assurance of peak efficiency and uniform capacity over long periods of heavy use. FloWays are equipped with standard cast iron or fabricated steel heads.

Local sources throughout the world carry replacement parts. Inquire about your specific FloWay today.

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**FIESE & FIRSTENBERGER MFG., INC.**
2494 S. Railroad Ave. Fresno, California

FIESE & FIRSTENBERGER PUMPS FRESNO, CALIF.

# . . . . . Am-Soc Briefs

▶ ▶ Addenda. . . . Among significant Cleveland actions of the Board of Direction that didn't make the June issue were: Endorsement of the Wisconsin Section's action in opposing an AIA-sponsored bill that would impose a special examination on engineers before they could design buildings; protest against amendments to the engineering registration law, recently enacted in Washington, which would permit corporate practice without the control provisions set forth in ASCE policy; and authorization of letters of commendation for Dr. Leroy E. Burney, Surgeon General, USPHS, and Maj. Gen. Emerson C. Itschner, Chief of Engineers, who as "administrators of large engineering organizations in public service have brought unusual recognition to their engineering personnel."

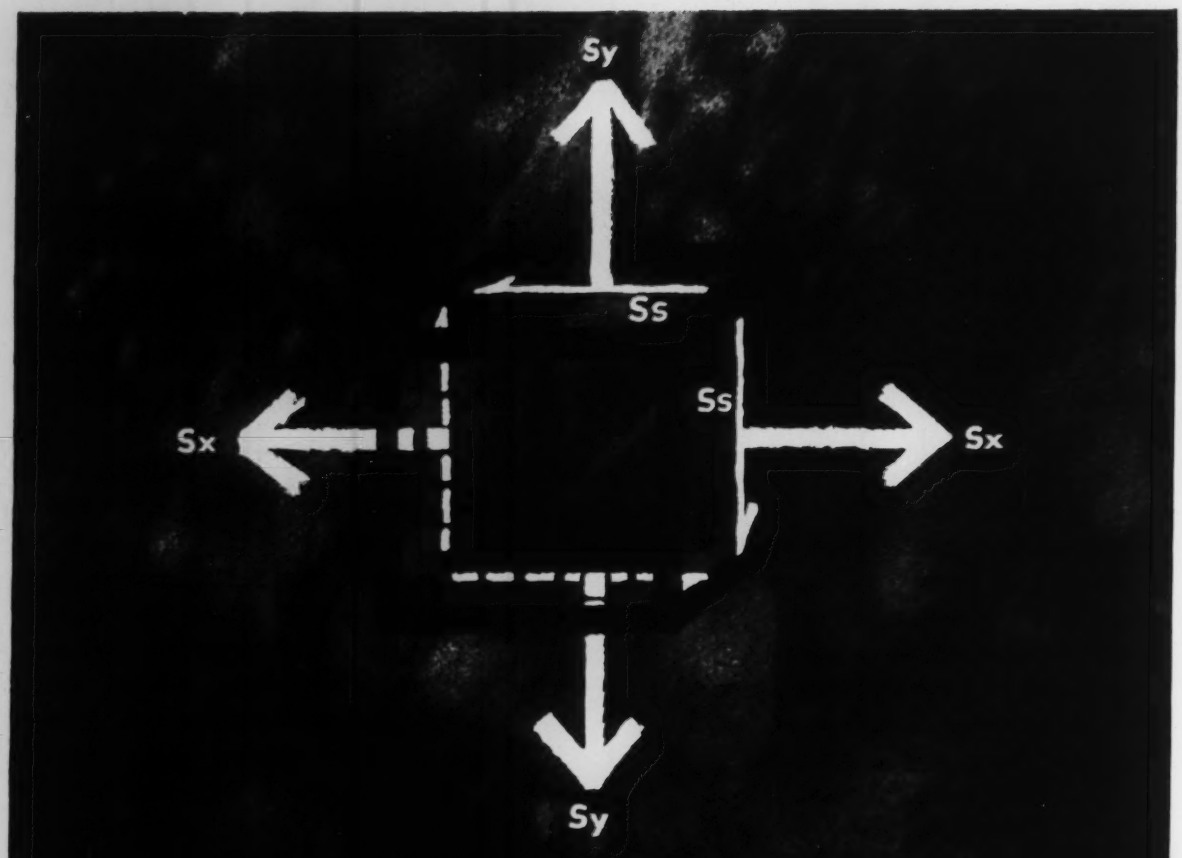
▶ ▶ On the theory that the background of recent Board actions is necessary to full understanding of these actions, considerable space in Society News is given to Society policy statements. These include the "1948 Policy Statement on Engineers in Public Practice" and a study of the Local Section role in professional conduct proceedings.

▶ ▶ Engineers planning to attend the Annual Convention are reminded that this year they will have a change of scene — Washington instead of New York. Keep in mind, too, that this Convention will be later than usual — October 19–23. The next two issues will carry full details. In the meantime, the Convention committee is stressing the wealth of construction projects underway in the Nation's Capital — the controversial extension of the east front of the Capitol, the Chantilly Airport (first to be designed from scratch with the needs of the Jet Age in mind), a housing redevelopment in the southwestern part of the city, and the piers for a new Potomac River bridge, to mention just a few.

▶ ▶ Examgems. . . . This issue sees the start of a new department under the aegis of R. Robinson Rowe, who as N. G. Neare has delighted puzzle fans for almost twenty years with his witty (and difficult) problems. From now on, under the name of Reggie Strashn, Mr. Rowe will bring to our readers each month significant problems actually used by registration boards.

▶ ▶ Early Transactions. . . . A rare opportunity to obtain the first ten volumes of Transactions (1872–1881) is being offered (May issue, page 77). Price will be about $150 for these ten historic volumes. To assure getting a set, orders should be sent at once to the Executive Secretary.

▶ ▶ Open spaces is the planned theme of the September issue. Members of the Alaska Section have contributed a number of articles on civil engineers and cold weather engineering in our new state. An Olympic-size swimming pool in Michigan, marinas in California, and a grandstand in New York will support the outdoor theme.




# ASSIGNMENT:

# ABRASIVE IMPACT

## How Lukens *Application Research* helps you find the right steel plate for the job

If your assignment is designing equipment to withstand abrasive impact, our Application Engineering staff can serve you. Their specialty is helping you track down the precise steel plate for any job. They research a problem from the design stage right through to how the equipment has performed for years after its installation. This practical observation and experience—combined with metallurgical know-how—is yours for the asking. It's been saving our customers money for years.

For example: working recently with a conveyor engineer, our people showed why 321 min. BHN quality Lukens "T-1" would perform equally as well as a previously used metal costing twice as much. On the other hand, the same group has suggested the regular quality of Lukens "T-1" for a uranium mine skip hoist, where a slightly softer steel will actually hold up longer. In still another conveyor application—in a coal preparation plant—our engineers demonstrated how stainless steel, Type 304, would produce long-term savings. The high initial cost of stainless was reduced by using it in Lukens clad plate form.

*If your assignment is abrasive impact, why not let it be our assignment, too?* Contact Manager, Application Engineering, 179 Services Building, Lukens Steel Company, Coatesville, Pa. Also ....

**ASK FOR LUKENS "T-1" STEEL BULLETIN**

**Helping Industry Choose Steels That Fit The Job**

**LUKENS**

# do you know that

**Engineers will do well to look to Alaska for future work?** The advice comes from Reclamation Commissioner Floyd Dominy, who says our 49th state offers "almost unlimited opportunities for low-cost power development." (Another word of advice—don't dash off without a hotel reservation!) Currently under investigation are a 45,000-kw Devils Canyon project on the Susitna River, about halfway between Anchorage and Fairbanks; a 65,000-kw installation to be known as the Snettisham Project, which will serve Juneau; and power sites to serve the Matanuska Valley. Much more breath-taking, of course, is the proposed billion-dollar Yukon River project, which would impound a reservoir larger than Lake Erie and supply 5,000,000 kw of power.

▪ ▪ ▪

**Turnpike travel is safer despite the higher speeds permitted?** Significant new evidence comes from the American Bridge, Tunnel and Turnpike Association, which reports that there were no traffic fatalities on the sixteen major turnpikes over the Memorial Day weekend, despite a traffic load of 157,000,000 vehicle miles. On the rest of the nation's highways there were 310 traffic deaths.

▪ ▪ ▪

**Los Angeles is building its first skyscraper?** The 18-story, 275-ft-high California Bank building going up in downtown Los Angeles is the first to be erected since restrictions limiting the height of buildings to 150 ft were lifted. Actually, under the old law, exceptions were made in favor of City Hall (464 ft high) and the Federal Office Building (257 ft high). Deterring factors in keeping up with the new code are the necessity of designing to resist earthquake effects and a code provision limiting building areas to thirteen times the lot size.

▪ ▪ ▪

**Tokyo is installing parking meters?** The serious traffic problem is responsible for this Western innovation. It costs ten yen (2.78 cents) to park for 15 minutes.

▪ ▪ ▪

**The new Seine River suspension bridge at Tancarville is Europe's longest?** With a main span of 2,000 ft, the Tancarville Bridge will hold the record for length until the 3,300-ft-span Firth of Forth Bridge (recently started in Scotland) is completed. It will have two 576-ft side suspension spans and an approach viaduct of eight 164-ft concrete girder spans, bringing the overall length to almost a mile. The 408-ft-high towers are of concrete instead of steel. Other notable features include the use of prestressed concrete for both the massive left-bank and tunnel-type right-bank anchorages and for the forty 164-ft girders in the approach spans. The bridge—to be operated as a toll facility by the Le Havre Chamber of Commerce—will be opened this July.

▪ ▪ ▪

**The railroad fill across Great Salt Lake is completed?** After two years under construction, the Southern Pacific's new $49,000,000 dike crossing will be in full operation by August 1. The 12.6-mile project will carry two tracks across Great Salt Lake at a height of 17 ft above water level. It replaces a sixty-year-old wooden trestle.

▪ ▪ ▪

**Port of New York shipyards have drydocks with total handling capacity of 350,000 tons?** This is more capacity than any other city has and two-thirds as great as the capacity of the entire West Coast.

▪ ▪ ▪

**Seattle will have the first mass-transportation monorail in the U.S.?** The $5,000,000 facility will be used to transport visitors from downtown Seattle to the centennial exposition grounds north of the city. It will be of the supported type, consisting of three four-car, 96-passenger trains, mounted atop a steel rail. Cars will be of aluminum powered by electric motors. They will travel 18 ft above the ground. The monorail will be in operation by the end of 1960, ready for the exposition scheduled to open in May 1961. When the exposition is over, the line will probably be the first unit in a proposed monorail system that would tie into the freeways. A monorail to carry sightseers has recently been put in service at Disneyland in California.

▪ ▪ ▪

**The U.S. and Canada will cooperate in building a new channel between Lakes St. Clair and Huron?** The $8,000,000 shortcut will permit two-way traffic between the Lakes and will ease travel between Lakes Huron and Erie. It will be 6 miles long, 700 ft wide, and 27 ft deep.

▪ ▪ ▪

**Four out of five engineers and scientists oppose collective bargaining for themselves?** This is the substance of a University of Michigan study, based on interviews with 277 non-supervisory professional employees in ten large firms. All the major engineering fields are covered. Of those favoring collective bargaining, half thought action should be taken by their professional societies, while the rest thought in terms of conventional labor union activity. The study, entitled "Collective Bargaining as Viewed by Unorganized Engineers and Scientists," sells for $1 and may be ordered through the Publications Distribution Service, University of Michigan, Ann Arbor.

## NEWEST OF PENNSYLVANIA'S

# 1,000 Prestressed Bridges!

Cordorus Creek overpass is banked for high-speed expressway traffic (note steps cast into bridge piers). Box-Beams were used for span over railroad tracks.

**Right,** two cranes place girder in severe cold. Pier in foreground accommodates both I-Beams and shallower Box-Beams.

● Starting just ten years ago with the first prestressed concrete bridge in America—the famed Walnut Lane Bridge in Philadelphia—Pennsylvania now has over 1,000 prestressed bridges in place. Under a recent policy of alternate bidding, 75 out of 80 contracts for spans up to 100 feet in length have been awarded to prestressed concrete.

The newest of these projects, and the first to be put out for alternate bidding, is a series of five bridges on the York By-Pass of the new Harrisburg-Baltimore expressway. Ranging from single-span to eight-span design, these bridges required 188 prestressed I-Beams, 36 feet to 80 feet in length. These were the first pretensioned, deflected-strand I-Beams used in the Northeast, and were similar in design to the girders used on the 220 Illinois Toll Road bridges.

The longest of the York By-Pass bridges is the Cordorus Creek overpass, shown above. This bridge required 84 I-Beams, ranging from 51-foot to 80-foot spans, and 20 prestressed Box-Beams for a span over railroad tracks. All beams were manufactured with 6000 psi concrete, using 'Incor' High Early Strength Cement.

With modern highway structures like this, The Pennsylvania Highway Department gains not only the traditional advantage of concrete's low maintenance cost, but also the benefit of *low initial cost*, proved in alternate bidding.

'Incor', America's FIRST High Early Strength Cement, has played an important role in the construction of Pennsylvania's 1,000 prestressed bridges—and continues to provide the dependable high quality so essential to rapid, economical production of prestressed members.

**YORK BY-PASS BRIDGES**
Harrisburg-Baltimore Expressway (U. S. Route 111)

Owner:
**PENNSYLVANIA DEPARTMENT OF HIGHWAYS**

Engineers:
**MICHAEL BAKER, JR., INC.,** Harrisburg, Pa.
**BUCHART ENGINEERING CORP.,** York, Pa.

General Contractor:
**LYCOMING CONSTRUCTION CO., INC.**
Williamsport, Pa.

Bridge Contractor:
**G. A. & F. C. WAGMAN, INC.**
Dallastown, Pa.

Prestress Fabricator:
**PENNSYLVANIA PRESTRESS, INC.,** York, Pa.

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CIVIL ENGINEERING

# *Five-percent engineering?*

**MASON G. LOCKWOOD, Past President, ASCE**

Partner, Lockwood, Andrews & Newnam, Houston, Tex.

There are some very auspicious opportunities for civil engineering inside the framework of present horizons. I have nothing to say here about the implications of the jet age, or the nuclear or the missile age, and I have no idea what the really new horizons are in those directions. But in our traditional practice and current concepts there are some widely overlooked and vastly underexploited opportunities for civil engineers or, we might say, new horizons inside the old horizons.

Civil engineering has utterly failed to develop its full creative potential. What is even more depressing, the margin between the civil engineer's actual and potential creativity is widening all the time. Though philosophical and instinctive conclusions of this sort never can be factually supported, I know that engineers of bygone generations utilized far more of their latent creative capacity than do we.

### Trend away from creativeness

The principal reasons for this trend away from applied creativeness are identifiable. Civil engineering is now being mass produced and mass marketed under the most severely competitive conditions. This is a professional contradiction of a very serious import.

The civil engineering of this country gets done through three systems: (1) the practice of engineers employed on a full-time basis by industry, commerce or business, including contractors and contracting engineers; (2) public practice by engineers employed by governmental agencies of one sort of another; and (3) private professional practice. This last system is known as consulting engineering, although consultation is no longer dominant in private practice. The incentive necessary to assure, motivate, or even encourage creativity is lacking, except in spots, in all three of these systems of civil engineering practice.

The end-products of the minds of civil engineers pretty generally are undertakings that must be custom built. Few civil engineers engage in the design or manufacture of consumer goods. Most are concerned with a series of one-shot propositions. For example, a particular bridge, or roadway or runway, or dam, or building or report or the boundaries or topography of a particular tract of land.

Creativity has definite application in every one of these situations. But such projects are not repeated in quantity. Hence neither industry nor government nor engineers in private practice are generally willing to allow time or money for avoidable engineering that is of an original, research or creative character. The whole process by which money or credit gets translated into civil engineering works actually stifles creativeness. This process is based on the false premise that a dollar saved on engineering cost necessarily means a dollar saved on project cost. The truth is that usually the best way to reduce capital costs is to spend more money for engineering—at least up to a point.

The absurd perversion of values responsible for most under-engineered projects is also responsible for a senseless waste of manpower, materials and money. All this is a direct product of engineers.

The pressure to reduce engineering costs is everywhere relentless. To the extent that efficiency is promoted and waste reduced, this pressure is desirable. But its most significant effect is to increase project costs by discouraging creativity, research, innovation, originality, and ingenuity in design.

To engage in such old-fashioned processes, the individual engineer must be surreptitious, must do them on his own time, or must take a chance on getting his economic head lopped off. Thus the young engineer is confronted with a particularly frustrating situation which restrains his naturally creative instincts. This frustration probably drives some engineers out of the profession, although they may not be conscious of this as the cause.

### Pressure to reduce costs

Consider the effects of this pressure to reduce costs in industry. The chief engineer, or his equivalent, finds himself hard pressed to justify the amount of engineering which he knows ought to be brought to bear on the civil engineering aspects of his company's business, in the interests of economy itself. Thus he becomes, in a sense, an apologist for engineering. As such he is the world's worst salesman. What is needed is a new and more positive attitude—more table pounders for engineering, more enthusiasts, fewer Casper Milquetoasts.

Precisely the same situation prevails in all forms of government engineering from the lowest to the highest levels. Heads of the engineering arms of some government agencies actually avoid the use of the word engineering in estimates of project costs, apparently as a matter of policy. This is because the work of their engineers is so little appreciated. Recently I examined a detailed project estimate prepared as an appropriation request by one far-flung agency. In this estimate the word engineering was omitted completely. Items were included for the project report, for plans and specifications, for supervision and inspection, and for overhead. These items, in the aggregate, amount-

ed to some 25 percent of the approximately $3.5 million estimated for the construction cost.

Such well intended but transparent concealments should be abandoned in favor of a more forthright, no-nonsense approach. The shameful inter-agency competition, which incidentally is not confined to federal levels, is responsible for some of this. What engineers ought to do is to call a spade a spade. If the engineering percentage is unjustifiably high—and I don't know that it is in the case cited—then that is where the ax should be applied. But whatever engineering costs are warranted, should be forthrightly noted, not abjectly concealed.

Private practice, the third system by which civil engineering work gets done, also is populated by notable apologists for engineering. Consulting engineers in our time compete not only with the other two systems, but also with each other. This competition is responsible for the trend toward larger and larger consulting engineering organizations which more and more adopt the techniques of business with a consequent flight from the professional procedures of a generation ago.

Few consulting engineers can afford either to preach or to practice the doctrine of more thorough engineering with its attendant higher costs. Only the most highly regarded and exceptionally respected engineers, with long established reputations, can get sufficient work to stay in business on this basis. Their professional competitors are eternally seeking devices with which to offer their services at some price advantage—while professing to follow the recommended fee curves.

### Engineers resist change

This economic competition is not the only reason why civil engineering is failing of its creative potential. There are some other causes of a very fundamental nature. These are inherent in the nature of civil engineers—at least in the civil engineers of this generation. For one thing, engineers are basically reactionary. They resist change inordinately.

Engineers are too inclined to be guided by arbitrary standards of design. They have a built-in ratchet in their make-up which operates to prevent any reduction of these standards but allows them to be increased. Engineers have unjustifiably come to regard these arbitrary design standards as though they were in the same category as the scientists' "negative affirmations," of which two examples have been given by Sir George Paget Thompson, the Nobel Prize winning atomic scientist, in explaining what the physicist means by the "principles of impotence": (1) that it is impossible to construct a perpetual-motion machine, and (2) that nothing can go faster than light.

Engineers have to be blasted loose from anything that has proven safe and workable. This is evidenced by the engineers' smug and sometimes extravagant reliance on ultra-conservative factors of safety. It has been observed that if a structure designed and built by a civil engineer fails, the cause is likely to be a mistake in design or construction rather than a disregard for the standard factors of safety. There are unlimited possibilities for reducing factors of safety responsibly all along the line through research, trial and error, and better engineering.

Curiously, it is only the construction phase of civil engineering that has been creative and daring during our time. Much of the real genius in civil engineering in the last generation has been evidenced in the construction industry. Phenomenal advances have been made in the application of men, materials and machinery to construction. Consider, for example, what has happened in the development and use of earth-moving and road-building machinery. The principal motivation in these construction advances clearly is the profit incentive. Perhaps that is the difference. But, on the other hand, perhaps not.

### Unlimited horizons

The horizons for research in engineering are virtually unlimited. To cite only one area, consider how ineffectual has been the spotty research done in building construction. Until the last few years, this research was utterly uncoordinated. It is still not adequately coordinated. The gains that have been made are primarily the result of the work of manufacturers with materials to sell, or of the genius of contractors seeking a competitive advantage over other contractors. To crudely gage the extent of this horizon within a horizon, merely recall that, to a large extent, we are still putting up buildings by manually laying one block of masonry on top of another, as men were doing before the birth of Christ.

### Meeting the demand for economy

Civil engineers in all categories—students, educators and practicing engineers alike—have been too preoccupied with the sheer joy of applying mathematics and mechanics to the solution of engineering problems. The larger aspect of applying engineering principles to the satisfaction of man's ultimate needs has been overlooked. In so far as they relate to civil engineering, man's needs can be stated simply. Man wants everything, whatever it is, built more cheaply and more quickly—houses, buildings, bridges, municipal improvements, dams, roads, harbors.

Engineers concentrate too much on building better, not enough on building more cheaply. The value of nearly everything civil engineers build is destroyed by obsolescence or change—not deterioration. Engineers seldom build anything that actually wears out, but nearly everything they build gets junked because of obsolescence. Why not gear things to a more reasonable life expectancy?

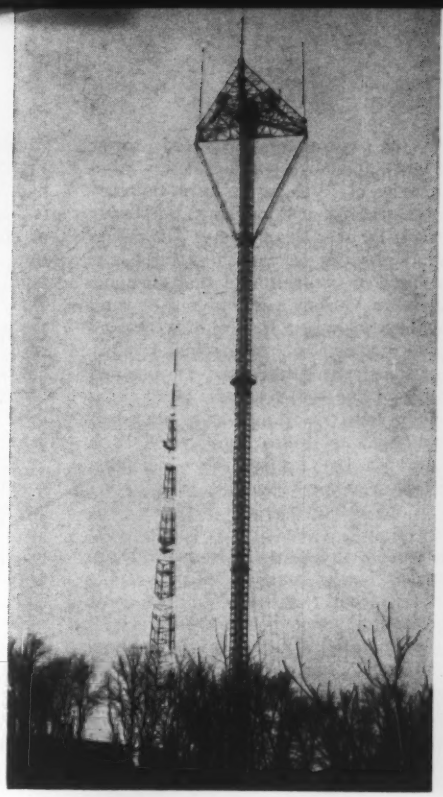
It seems to me, then, that the civil engineering profession, and of course this means the American Society of Civil Engineers, needs to turn its attention to measures that will reverse undesirable trends and, if possible, break up some of the hobbling practices to which attention has been called here.

Specifically, ASCE needs to find ways to assure the application of more comprehensive, more original, more creative engineering based on more research, wherever it can be justified. ASCE needs desperately to disabuse the minds of many laymen and some engineers of the strangely persistent notion that engineering costs 5 percent—period. Think what it would mean to the profession if people could be made to understand that a thoroughgoing job of original engineering—whatever it costs—is in the interest of economy for nearly all important projects.

The ASCE, because it is the bellwether of civil engineering, has a distinct responsibility in this area, just as it has in any other area that affects the present and future welfare of the profession and of mankind. Clearly here there is no conflict; what is good for the profession is good for mankind.

The sort of mechanism needed to explore these horizons within horizons is already in existence within the organizational structure of ASCE. I refer to the effective—but I think rather awkwardly named—Department of Conditions of Practice. Its highly significant purpose is to coordinate and stimulate the professional and economic aspects of engineering practice. It is suggested that the Department of Conditions of Practice of ASCE mobilize its exceptional capabilities and undertake a study of the potentialities here discussed. Specifically, it is suggested that it study and make recommendations on how to further more thorough, more custom-tailored, more creative engineering and research.

*(This article is from Past President Lockwood's address at ASCE's Pacific Northwest Conference of Local Sections in Helena, Mont., April 24, 1959. The theme of the conference was "New Horizons in Civil Engineering.")*



Baltimore's new candelabra-type television tower rises 730 ft above Television Hill. Serving all three television stations in Baltimore, the tower is the first ever constructed to support three antennas on the same platform.

# BALTIMORE'S CANDELABRA

**ROBERT S. ROWE, A.M. ASCE**

Professor and Chairman

Department of Civil Engineering

Duke University, Durham, N. C.

The Baltimore Candelabra, one of the most unusual structures ever designed for television transmission, was recently erected in Baltimore, Md. It is the first tower ever constructed to support three antennas on the same triangular platform. Some of the important design problems encountered were the acquisition of adequate land for economical guy-wire anchor locations, limitations imposed by the Civil Aeronautics Authority, limitations imposed by the Federal Communications Commission, local zoning ordinances, and the determination of a design wind for the strongest tower economically possible.

Recent improvements in television antennas and the desire to improve television reception led to the decision to support three antennas on the common tower. Ordinarily when height is not a critical factor, multiple antennas would be supported on a single tower by stacking them on top of one another. Although the Federal Communications Commission permits a tower height of 1,000 ft, the height of this tower was limited to 730 ft by the Civil Aeronautics Authority. Therefore it was decided to design a unique structure to support all three antennas on a triangular platform so that each would transmit from the same height. This type of structure, with all its antennas at the same elevation, has become known as a "candelabra."

Provisions have been incorporated in the design of the tower and its foundations to extend its height to 1,000 ft

Three sets of double guys are attached to the tower at each of the four guy levels. All four sets on one tower face are connected to a common reinforced concrete anchor at a distance of about 450 ft from the base of the tower. (See Fig. 1.) Provisions have been made for additional guys, which will be required if the tower height is increased to 1,000 ft.

when permission is granted by the Civil Aeronautics Authority.

### Design considerations

The design wind was based on existing records of the Weather Bureau and determined to be equivalent to 165 mph at an elevation of 1,000 ft, that is, at the maximum projected tower height. The corresponding design wind pressure of 70 lb per sq ft on flat surfaces was used throughout the tower height for reasons of safety. The design wind pressure on curved surfaces was reduced to two-thirds of that on plane surfaces. Various combinations of wind loading with gust factors of 1.33 were so located as to obtain maximum values for the shearing force and the bending moment for the tower design.

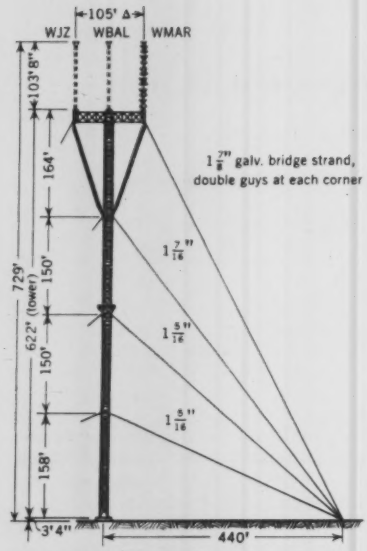



**FIG. 1. The tower is of triangular cross section with solid steel legs spaced 12 ft at the corners. Guy wires are connected to the tower at four different levels. On top are three antennas.**

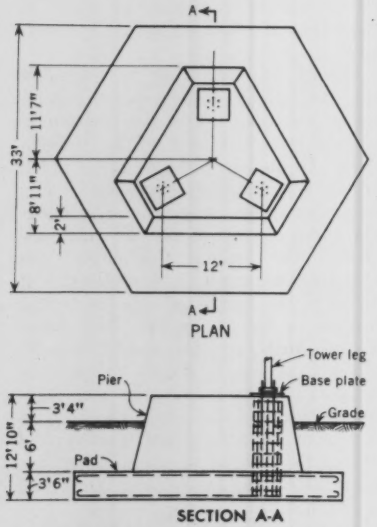



**FIG. 2. Center pier and pad on which it rests are shown in sketches.**

The tower is triangular in cross-section, with solid steel legs spaced 12 ft apart at the corners. The diameters of the legs vary from 5¾ in. to 7 in., and are of high-strength T-1 steel. The tower legs were fabricated in 30-ft lengths with jet-welded flanges. Diagonals are solid round members varying in size from 1 in. to 1¾ in. Girts or horizontal members are double angles predominately 4 in. x 3 in. x ¼ in. and 3½ in. x 2½ in. x ¼ in. All bolts have lock nuts and washers. The important dimensions of the 622-ft tower as built are shown in Fig. 1.

There are three sets of double guys at each of the four guy levels, one set attached perpendicularly to each face of the three-sided tower. The guy levels are spaced approximately 150 ft apart up the tower (Fig. 1). Guys are galvanized bridge-strand steel cable varying in diameter from 1 5/16 in. to 1⅞ in. with breaking strengths ranging from 212,000 lb to 432,000 lb.

To help prevent troublesome vibration in the guys, pairs of standard Alcoa Stockbridge dampeners have been employed. Even under high winds, the vibrations of the guys are hardly noticeable. Without a system of dampeners, cables tend to vibrate continuously and may even gallop with amplitudes of as much as 30 ft. The four sets of guys that are attached one above another on the same face of the tower extend out to a common reinforced concrete anchor located about 450 ft from the base of the tower.

The top platform is an open steel triangular framework, 105 ft on each side and 16 ft deep. It is supported at each of the three corners by a strut composed of a 150-ft triangular tower running diagonally from the 450-ft mark outward to the corner of the platform. The tower is serviced by an electronically controlled, two-passenger elevator running inside the tower framework from the base to the top of the landing. A system of catwalks connects the elevator landing with the corners and midpoints of the platform.

### Foundations

A tapered hexagon measuring 20 ft 6 in. between parallel faces, and 9 ft 4 in. deep, forms the center pier on which the base of the tower rests. See Fig. 2. This pier stands on a hexagonal pad 33 ft between parallel faces and 3 ft 6 in. deep. Approximately 300 cu yd of concrete were used in this foundation, which was designed for a maximum soil pressure of 6,000 lb per sq ft. The design loads on the top of this center pier consist of a compressive thrust of 3,800,000 lb, a bending moment of 5,300,000 ft-lb and the horizontal shear of 68,000 lb.

Each of the three guy anchors is a reinforced concrete polygon 33 ft square and 15 ft deep, requiring 600 cu yd of concrete. This mass of concrete at each guy anchor is necessary to withstand the large uplift of 1,160,000 lb plus an added factor of safety equivalent to a 100 percent overload. The anchors were designed also to resist a horizontal shear of 867,000 lb with an overload of 100 percent.

### Tower fabrication

The Baltimore tower was designed and fabricated by the Dresser-Ideco Company, Columbus Ohio, which provided the most modern plant facilities and equipment for machining and assembling its components. Because of the rigid requirements established for the structure, fabrication techniques had to meet stringent specifications. A circular jet welding device was used to connect each flange to its solid round vertical leg member. By the use of this welding device, tremendous heat was applied to the entire connection, thus assuring a continuous weld of uniform strength.

Half-inch gusset plates were welded to the solid round leg members which accommodate the horizontal and diagonal tower members. After the gusset plates had been welded, the legs were checked for accuracy, and their ends were milled parallel to each other. Finally the various members were tagged for shipment.

Because the members were shop fabricated to close tolerances, fast erection was possible and there was little chance for tower misalignment. No field fabrication was required beyond the occasional reaming of a hole in multiple plates thicker than 3 in. Accuracy was obtained by machine-shop jig drilling and jig welding. Primary members were pretested to prevent inaccurate adjustments in the field.

All members and connections composed of ordinary A-7 steel were completely hot-dipped galvanized to prevent rust. Because of the stainless character of the T-1 steel, and to eliminate any chance of embrittlement or cracking, members of T-1 steel were not galvanized.

The fabricated members were

shipped by rail as close to the site as possible. Trucks then transported them from the rail head to the site and unloaded them in the immediate vicinity of the tower to reduce additional handling. An accurate inventory was maintained to insure that all material would be at the site when needed so that construction could continue uninterruptedly.

### Erection methods

Before construction could begin, the site was prepared, and a precise layout of the foundations was made. A clear area from the center pier to each guy anchor, free from all underbrush and other obstructions, was obtained. Such clear areas are very important since each guy cable must be stretched out on the ground from the center pier to its distant anchor. The total length of guy cable used was approximately 14,000 ft.

Excavation for the tower foundations, placing of reinforcing steel, and placing of concrete proceeded as rapidly as possible even under adverse weather conditions. Over 30,000 lb of reinforcing steel were used in the foundations. Soil explorations were controlled by the Raymond Concrete Pile Co. Borings were made to determine the depths and strengths of bearing materials.

A total of 2,100 cu yd of concrete was used in the main center pier and in the guy anchors. Concrete was mixed at the site and deposited as close to its final position as possible to help prevent segregation.

While concrete was being placed, surveyors were continuously on the job to locate the guy anchor steel and anchor bolts for the 2-ton base plates to which the three legs of the tower would be connected.

Because of the precise layout of the foundations and the excellent fabrication of the component parts, a relatively short time was required for construction. Even though most of the erection was done during the winter months of November, December, and January, rapid assembly of the tower structure went forward without a single loss-of-time accident. A total of only 7,000 man-hours was expended in erecting the 500 tons of tower steel and guys.

Each member was completely bolted as construction proceeded. To add stability to the tower, temporary guys were provided at critical locations. As construction progressed, the permanent guys were strung, adjusted for initial tension, and the dampeners attached. The temporary guys were then removed. Prior to shipment, all cables were prestressed in the shop. Calibrated hydraulic jacks, as well as "guy meters" were used in the field to insure correct tensioning. Experience gained on previous jobs proved valuable and enabled the erection contractor to coordinate the efforts of all concerned.

During erection, crew members were carried to the top of the tower on a "headache ball." Once at the top of the tower, they used a two-man elevator for getting to the construction area. A gin pole at the top of the structure permitted the erection of the top triangular platform together with the built-up welded corner sections that support the antennas. The corner antenna assemblies, weighing approximately 20,000 lb each, were supported by three 150-ft diagonal struts. Because of the extreme weight of the antennas, it was not convenient to lift them fully rigged; instead they were lifted in two pieces of approximately 10,000 lb each.

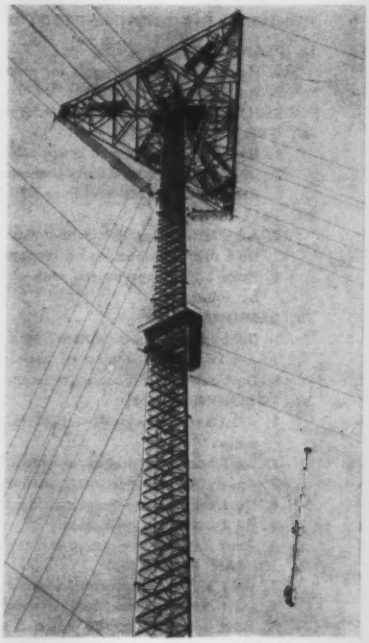
### Guy tensioning

One of the most time consuming and critical operations in tower construction is guy tensioning. Of the many possible ways to obtain initial tension in the guys, calibrated hydraulic jacks were chosen in this case. When such jacks are used, care must be exercised to insure proper adjustment, correct calibration, and adequate sensitivity of the dial gage. Careless handling of the jacks may result in disaster. To reduce the time required for guy adjustment, a "guy meter" was developed by the writer. This made it possible to continuously determine the tension in the cable by measuring the sag, the tangent intercept at the tower, and the inclination of the cable at the anchor.

Because of the high tension in the cables, the catenary of the guy approaches that of a parabola with a very small error. Thus it was quite easy to compute the sag at the center of the cable and the corresponding tangent intercept at the tower. By use of the tangent intercept, the angle of the cable with the horizontal at the anchor was computed as well as measured and compared with the value specified on the drawings. The tension in each cable was then checked by the calibrated jacks. The stages of erection proceeded rapidly and little time was spent in the final adjustment of the guys since independent checks had been made continuously. The guy meter was extremely successful and saved considerable time in all stages of guy adjustment on this tower.

Design and fabrication of the Baltimore Candelabra were carried out by the Dresser-Ideco Co. of Columbus, Ohio. The tower was erected by the John F. Beasley Construction Co. of Muskogee, Okla. The writer served as consultant to the Hearst Broadcasting Co. on this tower as well as on other towers throughout the country.

**A gin pole slung inside the tower was raised by cables as construction proceeded. To add stability to the tower, temporary guys were provided at critical locations.**



**Tower platform and a part of a batwing antenna rise skyward to become part of Baltimore's new television tower. A total of 500 tons of tower steel and guys are included in this new feature of Baltimore's skyline.**

# SELF-TRAINING IN ENGINEERING MANAGEMENT

**ALBERT A. GRANT, M. ASCE,** Assistant Chief Bridge Design Engineer, Department of Highways and Traffic, Washington, D. C.

Somewhere along the path of his technical development the young civil engineer will encounter a type of problem that defies mathematical solution—to achieve certain objectives not directly by his own efforts but by stimulating and coordinating the efforts of others. If he is to accept this challenge with confidence and enthusiasm instead of with fear and a sense of inadequacy, he will need previous self-training in the field of engineering management.

Too many civil engineers begin their professional careers with an "I'll cross that bridge when I come to it" attitude toward administrative and management practice. The fact is that, today, the dynamic areas of social and human relations are vital to the success of any endeavor in the scientific or technical field.

The weaning process from designer to executive is often painful. When the time comes to delegate work to others, the tendency is to draw back, to feel a lack of confidence in subordinates, and to assume an I-can-do-it-better-myself attitude. As a result subordinates lose self-confidence, develop a fear of criticism, and take an "it's easier to ask the boss" approach to the challenge of responsibility.

Assuming that the young civil engineer is aware of his need for training in management, how does he start his program for self-improvement?

As a first step, he should take a long look at his own characteristics, needs, and objectives. Every human being is endowed with certain natural gifts—some with physical assets, others with creative abilities, still others with strong powers of perception or tremendous drive or great patience. It is important for the potential executive to evaluate his attributes and deficiencies. Only then can he develop a custom-tailored improvement program, concentrating his efforts in areas of greatest need.

In the appraisal process, many engineers become discouraged by their lack of "Madison Avenue savoir-faire" or "dynamic bubbling personality." And yet our largest, most efficient, and most respected civil engineering organizations are administered at many levels by plain, mild-mannered individuals. These men have won the loyalty and respect of their subordinates, not by "fancy talk" but by delegating responsibility, encouraging self-expression, demonstrating technical ability, and furthering with confidence and integrity the programs of their organizations.

The civil engineer enters his professional life well-trained in the processes of orderly thinking. Perhaps without being aware of it, he has learned to accumulate facts, to arrange and analyze them logically, and to base conclusions and decisions on his findings. This technique can be of great value to the budding administrator in his approach to engineering management problems.

Beginning with his first day at work, the young civil engineer can develop an attitude of awareness and curiosity. The technical and management activities of his own work group can provide him with many valuable ideas and experiences. He can broaden and expand his knowledge of administrative action by asking himself such questions as "Why was this action taken? Did the results justify the effort? How was this decision made? Would I have acted differently? Why? How?"

As he undertakes more responsibility and advances in his profession, the engineering executive should prepare a series of questions that will test his administrative ability and judgment. Periodic self-examination with these questions will pinpoint the weak spots in his executive attitude. A check list of typical questions that the engineering

## Check List

### Questions the engineering administrator can use to measure his management ability

**I. PLANNING**
1. Have I set realistic goals for myself and my work group?
2. Am I planning effectively for the needs and growth of the organization?
3. Have I established priorities for the work to be done?

**II. ORGANIZATION**
1. Have I shown my men how each of their jobs fits into the total picture?
2. Does each person clearly understand his authority?
3. Are the organizational lines simple, efficient, and easy to follow?

**III. DELEGATION**
1. Am I effectively delegating responsibility and authority?
2. Do I avoid trespassing on responsibility once it is delegated?
3. Have I burdened myself with details that could be handled more effectively by others?

**IV. RESPONSIBILITY**
1. Do I face up to situations? Will I admit errors in judgment?
2. Am I making the most of promising new plans and ideas?
3. Do I get group reaction on important matters before going ahead?

**V. COMMUNICATION**
1. Am I keeping myself well informed about the accomplishments of the organization?
2. Do I handle questions satisfactorily?
3. Am I easy to understand? Do I explain the "why" of my decisions?
4. Do I come to the point quickly in discussions?
5. Do I express myself clearly in writing?
6. Am I keeping the group informed of progress, changes, and decisions?

**VI. HUMAN RELATIONS**
1. Do I express appreciation when an individual does a good job?
2. Do I make my men feel at ease when talking with me?
3. Have I won the confidence and loyalty of my men?
4. Do I encourage cooperation with members of other groups?
5. Do I listen understandingly to others in a discussion?
6. Have I recognized individual accomplishment outside the job?
7. Do I defend my organization against criticism?
8. Have I publicized outstanding work by members of my group?
9. Do I deal objectively with problems and situations?

administrator can use to measure his management ability is given in the accompanying box.

What about formal education? The questions in the check list might give the idea that an honest interpretation and reasonable practice of the Golden Rule is all that is needed for a successful executive. Certainly the Golden Rule is an invaluable guide for the practicing engineering administrator. But there is also a need for a formal framework of management principles and executive techniques on which to build, test, and expand the dynamic abilities of the individual.

By developing regular reading habits, the civil engineer can add immeasurably to his knowledge and understanding of administrative action. He can read books and magazines on the techniques of report writing, personality development, and public speaking. The knowledge, ideas and experience of the world's foremost educators and administrators can be found in the excellent management literature available today.

However, the stimulus for self-expression created by formal education cannot always be found in books. The free exchange of ideas in the classroom, the exacting rigors of a written assignment, the five-minute speech before a critical audience of fellow students—these are the situations in which a realistic appraisal of the individual's progress can be made.

Engineering educators are aware of the need for broader formal training in the dynamic areas of human relations and administrative disciplines. Six years ago, The George Washington University in Washington, D. C., inaugurated a graduate program in the School of Engineering leading to the degree of Master of Engineering Administration. Among the courses offered are "The Engineer and Society," "Communication of Ideas," "Economic Analysis in Engineering Planning," and "Contract Administration."

Today some 350 graduate engineers and scientists are enrolled in the program as candidates for the masters degree. The writer is privileged to be among this group, which includes many high-level engineers and scientists who have recognized the need for formal administrative training in advancing their professional careers.

In summary, then, the development of executive ability is a vital and fascinating challenge to the civil engineer. Fortunately the opportunities for acquiring administrative skill are readily available to any alert indivdual. He can establish his own program for self-development by: (1) setting his objectives; (2) appraising his current status and needs in relation to these objectives; (3) choosing the means for satisfying those needs; (4) setting aside the necessary time for study, whether for regular reading or for specific courses; (5) putting what he learns into practice; and (6) continuously reappraising his achievement.

There is no quick and easy formula for executive success, but the greatest rewards of professional life go to him who achieves this goal.

# HEAVY-WEIGHT CONCRETE STABILIZES TOWER FRAMES

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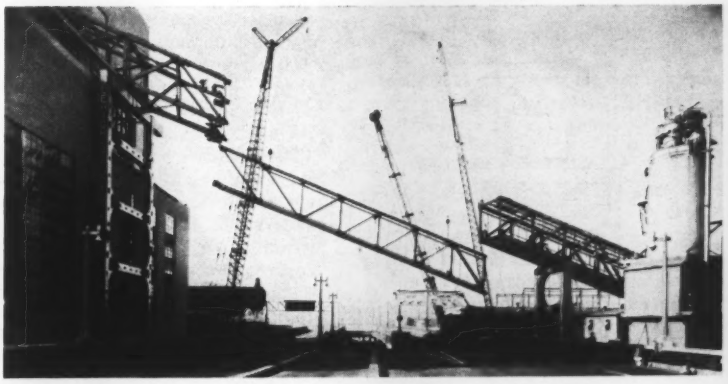


**Structural steel for coal conveyor bridge is being erected across New York's West Side Drive. Top of Tower "A" is seen extending above the elevated Drive at right, and Tower "B" stands close to powerhouse building at left.**

Heavy-weight concrete, weighing 290 lb per cu ft, recently was used to stabilize two high towers in a modernization program for the New York City Transit Authority's 59th Street Power Plant. (Since this article was written, the Transit Authority's power plants have been sold to the Consolidated Edison Company of New York, Inc.) Installation of two 36-in. coal conveyor belts in a new bridge over the West Side Drive required tall towers with resulting large overturning forces.

Very little design information was available on heavy-weight concrete and few contractors were experienced with this material. The heavy concrete, used in this case for its high unit dead weight only, is very similar to that sometimes employed for shielding atomic reactors and other nuclear installations. Concrete mix and cost data are presented for this waterfront project whereby coal, unloaded from barges by tower hoists, is to be moved across the elevated expressway to the power plant. See Fig. 1.

Because of the location of its power plants within the City of New York, it is the policy of the Transit Authority

to use fully enclosed coal conveyor bridges to minimize dust and dirt problems. This requirement imposed very severe structural requirements on the two supporting towers for this coal conveyor bridge due to the design wind loads. Since both the bridge and the towers are fully exposed to view, stainless steel siding for the bridge, and Vierendeel-type supporting towers, were chosen for esthetic reasons.

Both towers are similar in shape and structural action, although different in height, width and size. See Fig. 2. Also, their foundations are similar. The high overturning moment at the base of the towers would normally require massive concrete foundations. Space limitations and foundation conditions, however, made such foundations impractical and led to an increase in the effective overall height of the towers.

Tower "A," along the bulkhead line, had to be located over an existing relieving platform whose deck, 7 ft below grade, limited the depth of concrete that could be poured. This relieving platform had to be punctured and some of its timber piles removed in order to install the Drilled-in caissons chosen to support the tower foundation. The Drilled-in caissons extend 48 ft to rock and are socketed into the rock for a depth of 13 ft. Rock is overlain with riprap, silt and clay. If the lateral supporting value of this overburden and the backfill above the relieving platform are neglected, the overall height of Tower "A" is about 107 ft.

Tower "B" is located over an existing ash tunnel allowing vertical space of about 7 ft under the sidewalk level in front of the main building entrance. This limited the depth of concrete that could be placed to resist overturning. Rock in this area, which is 52 ft below grade, is also overlain with riprap, silt and clay. This tower foundation is also supported on Drilled-in caissons and, if the supporting value of the over-burden is neglected, the overall height of Tower "B" becomes about 165 ft.

There is no structural connection between the bridge and the power plant, and the bridge steel, siding and belt systems have provisions for longitudinal, vertical and transverse expansion and contraction due to temperature and loading variations.

A study of the wind forces, dead load of the bridge, towers, foundation pads and Drilled-in caissons revealed the need for additional weight to maintain the stability of the structure with a minimum acceptable factor of safety. Of the various schemes investigated, hollow steel tower legs filled with heavy-weight concrete appeared to offer the best solution. It was of course obvious that the heavier the unit weight of the concrete, the smaller the plan dimensions that would be needed for tower legs, their minimum size being that required for the performance of their structural function.

A literature investigation was instituted to determine what maximum unit weight could reasonably be specified. This study revealed that as the reported unit weights of concrete increase, less and less information seems to be available. Almost all the recent papers in this field were written about concrete used for nuclear shielding requirements. The results of this investigation led to the decision to require a weight of 290 lb per cu ft. Since the heavy-weight concrete used in the tower legs has no structural function other than to transfer its weight to the columns to stabilize the towers, and since the concrete is used in a heavy section permanently confined in the steel columns, a minimum cylinder strength of 2,000 psi was considered sufficient. No other requirements for the heavy-weight concrete were written into the specifications.

The contract, of which the towers and heavy-weight concrete were a small part, was awarded on the basis of competitive bids. Before the contractor was permitted to place any heavy-weight concrete in the towers, he was required to submit for testing six cylinders made from the mix he desired to use.

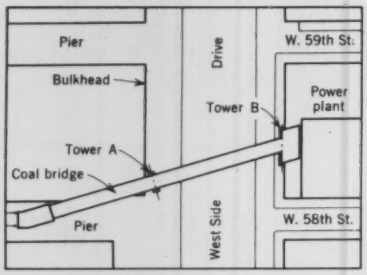
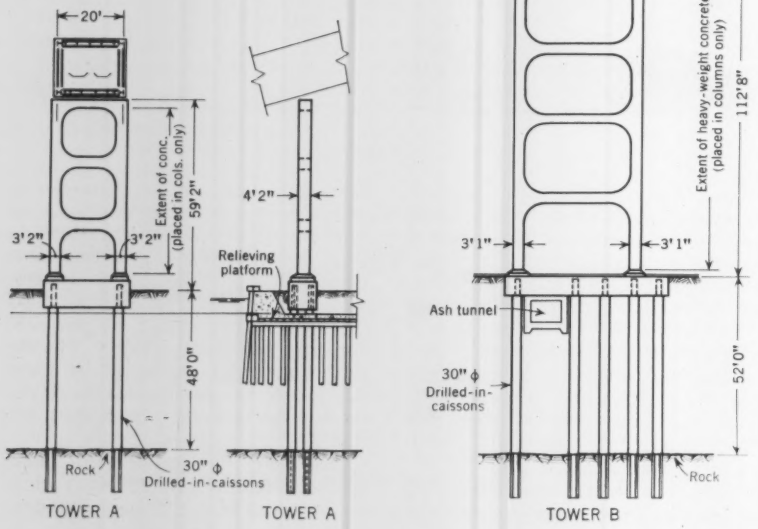



**FIG. 1. Plan shows location of Towers "A" and "B" in which heavy-weight concrete was used. These towers support the coal conveyor bridge that connects the pier with a power plant serving New York City's subways.**

**FIG. 2. Tower "A" is seen in two sections, Tower "B" in one. Legs of Tower "B" are 2 ft 9 in. deep.**




## Ore and punchings

The contractor's proposed mix consisted of a Type I Portland cement, magnetite sand, magnetite ore, steel punchings, a Pozzolith admixture and water. Since no requirements were included in the specifications for the type of aggregate or its gradation, no samples were submitted for analysis. A visual inspection indicated that the magnetite ore was fairly well graded from 2 in. down to about ½ in. The magnetite sand was very fine and probably most of it would have passed through a No. 30 sieve. The steel punchings were graded from ⅝ in. down to about 3/16 in. All punchings were steam cleaned and there was no evidence of any grease or oil on them.

The test cylinders were weighed when they were made and again after they had been cured for 7 to 28 days. Seven and 28-day strength tests were also made. Because the mix had very little workability, it was found necessary, in order to compact the concrete, to use a mechanical vibrator held on the outside of the test cylinder forms instead of tamping with a rod. This, in turn, required the use of steel forms rather than cardboard cylinders.

After several trial batches, the contractor, with the assistance of the engineers, was able to submit for testing a mix whose cylinders met the specifications and it was then approved for use. Table I shows the weights for a theoretical batch of 1 cu yd.

Some pertinent facts concerning this mix follow. Its theoretical unit weight when batched is 308 lb per cu ft. The approximate amount of uncombinable water in the mix is 9 lb per cu ft. The approximate unit weight when cured is 299 lb per cu ft (290 required). The water-cement ratio is 7 gal per sack of cement. The cement factor is 5.27 sacks per cu yd. The volume of the paste is 7.44 cu ft, or 27.5 percent of the absolute volume of the concrete.

The volume of the aggregate is 19.63 cu ft, or 72.5 percent of the absolute volume of the concrete. The percentage of the aggregate by absolute volume is:

| | |
|---|---|
| Magnetite sand | 31.1 |
| Magnetite ore | 32.5 |
| Steel punchings | 36.4 |
| Total | 100.00 |

The probable compressive strength of the mix is 3,200 psi at 28 days, based on 6-in. x 12-in. cylinders moist cured under standard conditions.

### Control of concrete

To control the concrete during construction, the batching as well as the placing was strictly supervised. Water was allowed to be added to the mix only at the job site. In addition to the standard test cylinders made during construction for later laboratory curing and testing, a wet-weight check was made on one test cylinder from each transit-mix truck. The average weight from two consecutive trucks had to be at least equal to the average wet weight recorded for the approved trial batch, before the trucks' contents were allowed to be placed in the tower legs.

Twenty-nine of these test cylinders had an average wet weight of 310 lb per cu ft, ranging from 328 to 297 lb per cu ft. Since the amount of uncombinable water in the mix is no more than about 9 lb per cu ft, it can be seen that there was an ample margin for evaporation over the specified weight.

Standard test cylinders were laboratory cured in a moist room until they were tested, and then weighed and broken at the end of 7 and 28 days in accordance with standard testing procedures. See Table II. A total of 30 cylinders were made to represent the approximately 95 cu yd of concrete that was placed over a period of 8 days. These test cylinders were also made in steel forms and mechanically vibrated.

Since all the cylinders were cured by storage in a moist room until the time of test, there was no chance for normal loss of weight due to evaporation. This is shown by the wet, 7- and 28-day weights, all of which were very close to the theoretical unit weight as batched. This also indicates that the usual absolute-volume method of proportioning concrete is a satisfactory starting point for trial batches. As far as the strength is concerned, it can be seen that there was considerable variation from the average. The averages, however, do show that the usual relationship of strength to water-cement ratio is somewhat high for proportioning this type of heavy-weight concrete.

### Cost data and erection

The four tower legs that were filled, two in Tower "A" and two in Tower "B", required about 95 cu yd of heavy-weight concrete. No form work was needed to hold the concrete because the steel plates of the columns served that function. The original construction schedule called for the work to be done early in 1959, but it was actually performed in November of 1958. In February 1957 the engineers estimated the cost of the heavy-weight concrete at $250 per cu yd. When the bids were opened, the average unit price bid of four contractors was found to be $356 per cu yd, the prices ranging from $240 to $460 per cu yd.

The contractor elected to use transit-mix trucks loaded to about half their volume capacity to deliver the concrete to the site. Batching was done by weight at a central plant. Water was added at the site and a truck-mounted crane and bucket transferred the concrete from the trucks to the towers. The concrete was then chuted into the columns through the access holes provided in one web of each tower leg. As the concrete rose in a column, welded steel plates were added to close the lower holes so as to retain the concrete. The contractor built a movable working platform from which to handle the chuting and also the vibration of the concrete after it was placed.

Field supervisors for the engineers reported that the concrete, after being placed and vibrated, had a density at least equal to that achieved in the test cylinders. Concrete was placed in both tower legs simultaneously so as to reduce the rate of rise in each to a value that it could safely withstand. If aggregate had been available in sufficient quantity, it would have been possible for the contractor to fill the tower legs in three working days and still stay within the limitations imposed by the use of these legs as forms. As it was, delays in delivery stretched the placement time to eight days.

Experience gained in designing and placing this concrete mix, weighing over 290 lb per cu ft, indicates that the use of such a mix is technically feasible. If required by the design and justified on an economic basis, mixes of this weight can be proportioned using existing techniques. Construction methods and equipment intended for the making and placing of ordinary concrete can be successfully used for heavy-weight concrete.

Engineering design and supervision of construction for the modernization of the 59th Street Power Plant are being done by The J. G. White Engineering Corporation for the New York City Transit Authority. The P. J. Carlin Construction Company is the general contractor for this phase of the modernization program.

G. J. Tzougros, Assistant General Superintendent (Power) and L. C. Benos, Superintendent (Power) are in charge for the Transit Authority. For the J. G. White Engineering Corporation, M. P. Aillery, F. ASCE, Chief Structural Engineer, is in charge of all structural and civil work and R. McLaughlin, A.M. ASCE, is Resident Supervisor.

**TABLE I. Weights for a theoretical 1-cu yd batch of heavy concrete**

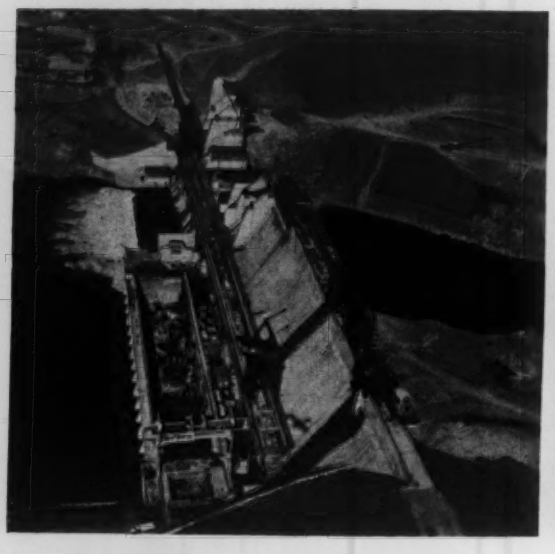
| Material | Specific Gravity | Weight lb | Absolute Volume, cu ft |
|---|---|---|---|
| Cement | 3.15 | 495 | 2.52 |
| Magnetite sand | 5.20 | 1,980 | 6.10 |
| Magnetite ore | 5.10 | 2,030 | 6.28 |
| Steel punchings | 7.85 | 3,500 | 7.15 |
| Pozzolith | . . | 1.5 | . . . |
| Water | 1.00 | 307 | 4.92 |
| Totals | 4.94 | 8,313.5 | 27.07 |

**TABLE II. Test cylinder data**

| | Average | High | Low |
|---|---|---|---|
| *Nine cylinders tested at 7 days:* | | | |
| Unit weight, lb per cu ft | 307 | 324 | 300 |
| Compressive strength, psi | 2,516 | 4,093 | 1,533 |
| *Twenty-one cylinders tested at 28 days:* | | | |
| Unit weight, lb per cu ft | 314 | 329 | 302 |
| Compressive strength, psi | 2,820 | 4,919 | 1,565 |

## A MULTIPLE-TYPE STRUCTURE OF EARTHFILL AND CONCRETE

**Four stages of power-unit installation are seen in this aerial view. Scroll cases are TI steel. Concrete from the plant at top left was placed by the two whirler cranes.**



**Concreting on Noxon Rapids Dam is seen approaching completion in September 1958. Reservoir has been cleared and Southwest Wing Dam completed. Note the concrete plant at left.**

# NOXON RAPIDS DAM——

**K. O. STRENGE, F. ASCE**

Chief Civil Engineer

The Washington Water Power Company

Spokane, Wash.

For the earth and concrete Noxon Rapids Dam in Montana, extraordinary geologic and topographic difficulties were overcome to provide water-tightness. One feature, a grouted-gravel (in place) cutoff to rock, presented an unusual construction challenge which was accepted and bested. The hydraulic turbine runners are especially noteworthy; they are among the largest of their type in existence and had to be assembled in the field because of shipping limitations. The scroll case is T-1 steel, a new material in this field.

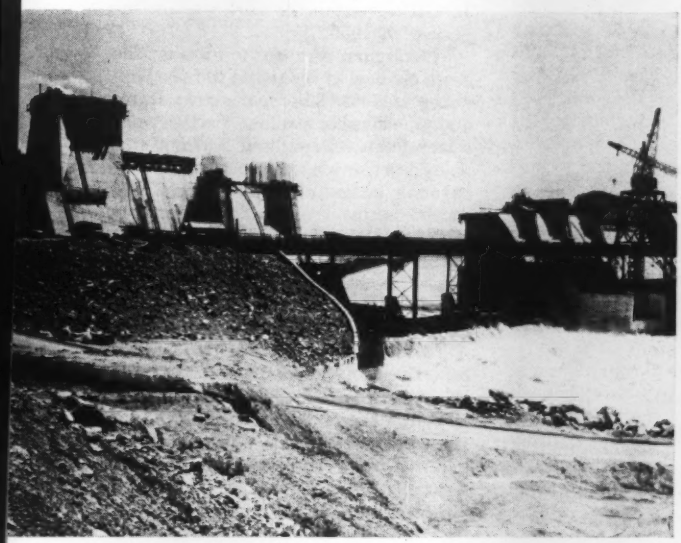
The 400,000-kw Noxon Rapids project is a property of the Washington Water Power Company, which was incorporated in 1889 and by 1950 was serving a load of about 360,000 kw. Since 1940, the load has grown at a rate exceeding 10 percent per year. To meet this growth, the 200,000-kw Cabinet Gorge plant was built on the Clark Fork River in 1950-1952, and while it was under construction investigation was started at the Noxon Rapids site, just upstream on the Clark Fork (Fig. 1).

Noxon Rapids Hydroelectric Development, with its initial capacity of 400,000 kw, will start carrying load in September 1959, and four units will be in operation by March 1960. This will again double the installed capability of the Washington Water Power Company. Provision is being made for the addition of a fifth unit.

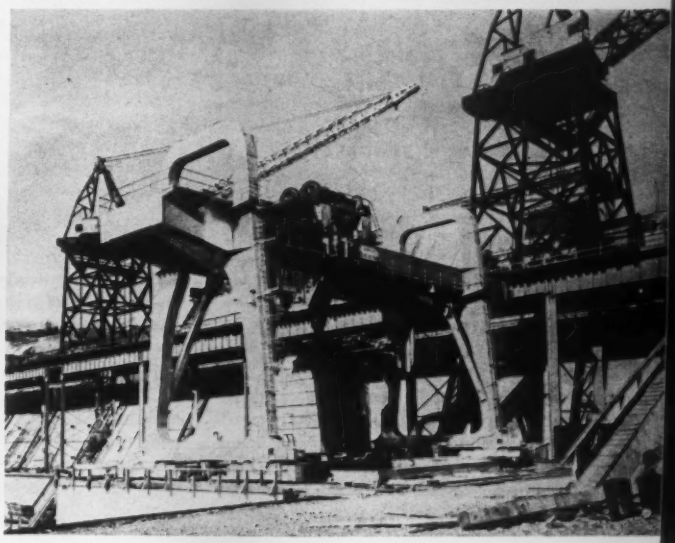
The Noxon Rapids project is on the Clark Fork River in Sanders County in northwestern Montana, 18 miles from the Idaho-Montana state line. A profile of the river, Fig. 1, shows development of the Clark Fork and the tributary Flathead River.

A federal license for the project was issued on May 12, 1955. Ebasco Services Inc., was engaged to do the engineering, design, purchasing and management of construction. Relocations and reservoir clearing began in August 1955. In April 1956, a contract was awarded to Morrison-Knudson Com-

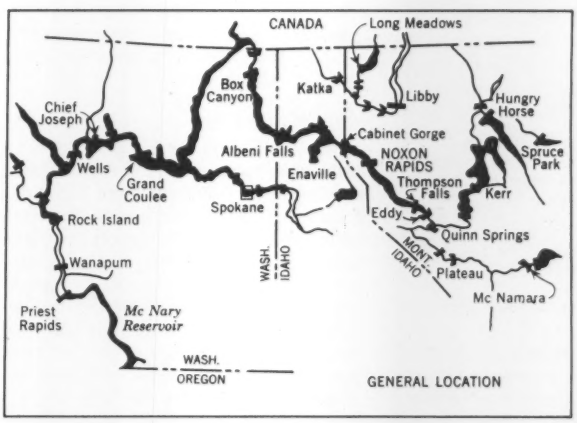
The 99,400-cfs flood of May 1958 was forced through the sluiceway left in the dam. After the Spring run-out the gap was concreted. The pool was filled in April 1959.



The 325-ton American powerhouse gantry has a rigid frame and is designed so that the hook can pass through the legs to serve a wide area. The unit is shown with a 406-ton test load.



# meets extraordinary geologic conditions



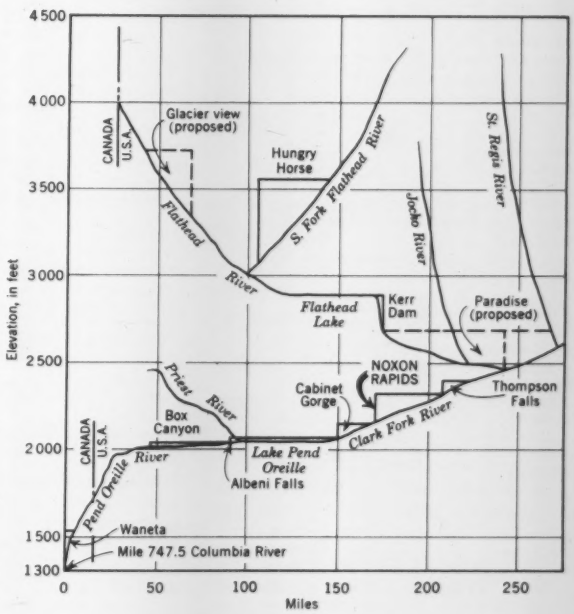




**FIG. 1. Noxon Rapids Dam is in an area of high runoff, where advantage can be taken of storage on up-river reservoirs. Profile, at right, shows intensive development of Clark Fork. Noxon Rapids project utilizes full head between Cabinet Gorge project of Washington Water Power Company and Thompson Falls project of Montana Power Company.**

pany for the construction of the dam and powerhouse. About 100 contracts have been awarded for the total project. An article on "Railway and Highway Relocation at Noxon Rapids Dam," by G. R. Latham and W. G. Saville, Fellows ASCE, appeared in CIVIL ENGINEERING for March 1959, vol. p. 150.

### River controls construction sequence

Above Noxon Rapids, the Clark Fork River drains about 21,500 sq miles, a considerable part of which is at altitudes of several thousand feet. The regime of the river is therefore typical of the northern Rocky Mountain region, with late spring floods due to snow melt occurring from the middle of April to the middle of July. The Flathead River is the main tributary above Noxon, and is subject to regulation by Kerr Dam and Hungry Horse Dam. Kerr Dam, just below the outlet of the natural Lake Flathead, controls 1,218,000 acre-ft in a 10-ft drawdown, and at Hungry Horse 446,000 acre-ft are used for river control.

The flow at Noxon Rapids, based on stream gaging records dating back to 1910, can be summarized as follows:

| | |
|---|---|
| Regulated minimum flow... | 12,000 cfs |
| Average annual flow..... | 18,000 cfs |
| Average annual flood flow.. | 90,000 cfs |
| Maximum flood of record... | 193,000 cfs |
| Average annual discharge.. | 15,000,000 acre-ft |

For comparison, the average annual discharge of the Colorado River at Hoover Dam is 11 million acre-ft, and that of the Snake River at Weiser, Idaho (just above the Hells Canyon of the Snake River) is 13 million acre-ft.

The entire design and construction scheduling of the project was controlled by the well-defined regimen and capacity of the river as outlined above. An elaborate sequence of construction operations and cofferdamming was developed to bypass the river flow. The key to the cofferdam program was a rocky island in mid-river which was used as an abutment for successive stages of cofferdamming.

In June 1956, an earth cofferdam was built to enclose the north river channel, and inside it a part of the spillway was constructed. This section of the spillway contained eight low-level sluiceways, each 12 ft wide by 17 ft high. These sluices had a discharge capacity of 30,000 cfs under a head of 10 ft and were adequate for the low-water flow, which occurs between August and April. A 180-ft gap was left in the spillway above these sluiceways for the passage of floods, which occur between April and July. This part of the work was accomplished in 1956.

The original plan was to unwater the south channel of the river after the high water of 1957. The contractor, at his option, cofferdammed and partially unwatered this area early in 1957 and was able to perform a useful amount of excavation work in the powerhouse and south abutment area. The cofferdams were breached to allow passage of the 1957 flood of 80,000 cfs. In June 1957 the south-channel cofferdams were restored and work was concentrated in the intake and powerhouse area. By April 15, 1958, all parts of the dam except the low gap in the spillway were raised to at least El. 2240, which forced the 99,400-cfs flood of May 1958 through the spillway sluices and the gap. (All elevations are for U.S.G.S. datum.)

After the 1958 flood, all parts of the dam were raised and were practically completed by April 1959. The final closure was made by dropping sluice gates in the diversion sluices on April 3, 1959, during the spring rise, when the flow approached 35,000 cfs. This was to reduce the reservoir filling time to a minimum, while Cabinet Gorge operated by drawing on its reservoir. The water was raised to El. 2299 in 5½ days.

Hydraulic model tests conducted at the Albrook Hydraulic Laboratory at Washington State College covered all phases of river diversion and were an invaluable engineering tool in establishing the design of the successful diversion facilities.

### Construction plant

Some half-million cubic yards of concrete were placed in the period from mid-September 1956 to April 1959, despite a 2½-month shutdown in the winter of 1956-1957. The aggregate plant upstream from the dam processed glacial gravel and was essentially a screening, washing and sand classifying operation with a rated capacity of 50 tons per hr for fine aggregate and 180 tons per hr for the four sizes of coarse aggregate—6 in. to 3 in., 3 in. to 1½ in., 1½ in. to ¾ in., and ¾ in. to No. 4. Aggregates were trucked to stockpiles just downstream from the automatic batch plant, reclaimed through a tunnel, and transported on a conveyor belt rated at 400 tons per hr to an automatic batch plant feeding two 4-cu yd tilting mixers. The concrete was dumped in 4-cu yd buckets, which were moved to

## Noxon Rapids Project

**Estimated cost:**

| | |
|---|---|
| Relocations | $22,000,000 |
| Power development | 65,000,000 |
| Total project | $87,000,000 |

**Capacity and energy (four initial units):**

| | |
|---|---|
| Capability | 400,000 kw |
| Firm capacity | 252,000 kw |
| Annual firm energy: | |
| Under critical water conditions | 1,452,000,000 kwhr |
| In median water year | 1,714,000,000 kwhr |

**Reservoir:**

| | |
|---|---|
| Area, 6,000 acres | H. W. L., El. 2331.0 |
| Volume, 500,000 acre-ft | Drawdown, weekly, 15 ft |
| Clearing, 9,000 acres | Usable storage, 115,000 acre-ft |

**Relocations:**
Northern Pacific Ry. (main line), 20 miles with 5 bridges
State Highway, U. S. 10A, 10 miles with 3 bridges
County and Forest Service roads, 20 miles with 3 bridges

**Dam:**

| Sections | Length, ft | Max. Height, ft | Volume, cu yd |
|---|---|---|---|
| Northeast Wing dam | 1,800 | 225 | 1,035,500 |
| Southwest Wing Dam | 3,000 | 165 | 1,921,000 |
| Concrete, non-overflow sect. | 580 | 265 | 225,000 |
| Concrete, overflow section | 470 | 190 | 252,000 |
| Total | 5,850 | | 3,433,500 |

**Spillway:**
Discharge, 250,000 cfs at H. W. L., El. 2331
Gates, 8 Tainter, 40 ft wide x 35 ft high
Energy dissipation, dentated sill

**Intake:**
Trash racks 3½-in. clear spacing; net area velocity, 1.4 fps
Provision for mechanical raking
Gates, 4-wheeled vertical, 30 ft 2 in. x 22 ft 0 in. wide

**Penstocks:**
Five of 26-ft inside diameter, 136 ft long

**Powerhouse:**
Outdoor type with 325-ton gantry crane
Concrete volume, 74,000 cu yd

**Francis turbines:**
Four initially
Manufacturer, Allis-Chalmers
Speed, 100 rpm
Rated output, 130,000 hp at 152-ft net head
Expected output, 137,500 hp at 152-ft net head
Scroll case, T—1 steel, field welded
Runner diameter, 232.85 ft

**Generators:**
Four initially
Manufacturer, General Electric
Speed, 100 rpm
Rated output, 70,720 kw at 0.8 power factor, 60 cu yd, 14.4 kv
Type, umbrella, outdoor

**Transformers:**
Seven, 3 single-phase for each 2 generators, 1 spare
Manufacturer, Westinghouse
Rated, 66,300 kva, 230/13.8 kv, class FOA

**Transmission lines:**
Power, 230 kv
Wood poles with H-frame
Noxon to Cabinet Gorge, 17½ miles
Noxon to Kellogg, Idaho, 45 miles
Noxon to BPA line, 2 miles

Note: All elevations are for U.S.G.S. Datum.

the whirly cranes on flat-cars pulled by donkey engines. The two trestle-mounted, whirly cranes each had a lifting capacity varying from 35 tons at 50 ft to 6 tons with the boom fully extended to 178 ft. The maximum batching and placing rate was 200 cu yd per hr.

### Unique features of dam

At the project site, the river is largely entrapped in a rock channel. This rock, on which the concrete structures are founded, is classified as an indurated (hardened by heat and pressure) argillite. The channel, however, lies in a wide valley which thousands of years ago was the bottom of glacial Lake Missoula. During and subsequent to the existence of this lake, various strata of clays, sands and gravels were deposited in the valley floor. With the failure of an ice dam located some 25 miles downstream from Noxon Rapids, various erosive effects were caused by the outrushing waters of the lake. While some of the gravel beds are of open structure and highly permeable, the clay and silt beds are so disposed as to make the gravel deposits generally lenticular in form. The net result is a somewhat heterogeneous assortment of material overlying the rock bottom of the valley.

The geologic and foundation investigation to define site conditions was very extensive; over 200 holes were drilled, supplemented by test pits and seismic refraction surveys. The exposed bedrock disappears at the water's edge and is covered to great depths by gravel and clay beds.

The most economical form of dam to meet the topographic and geologic situation was found to be a combination of two major earthfill wing dams one on each side of a central concrete spillway and intake dam. A major factor in favor of the earthfill wing dams was that clay, sand and gravel were available in sufficient quantity within the site area. See Figs. 2, 3, and 4.

Both earth dams are constructed with clay cores, supported and protected by sand and gravel fill (quarry-run stone is substituted in the transition area adjacent to the concrete structures), with riprap on the upstream slope. Here the similarity between the two wing dams ends; the right or northeast dam has a core founded on rock, while the core of the southwest or left dam is founded on a natural clay stratum up to 30 ft thick, which extends upstream for a half mile or more. On this side the depth to bedrock was so great as to prevent the economical construction of a cutoff through the gravel and clay material overlying the bedrock. Of interest in connection with the southwest wing dam is its volume of 1,920,000 cu yd and the clay blanket that covers some 850,000 sq ft

**Potholes are not uncommon at dam sites but this one at Noxon Rapids was of extraordinary size. It extended 80 ft below the surrounding rock and required 22,000 cu yd of concrete to fill.**

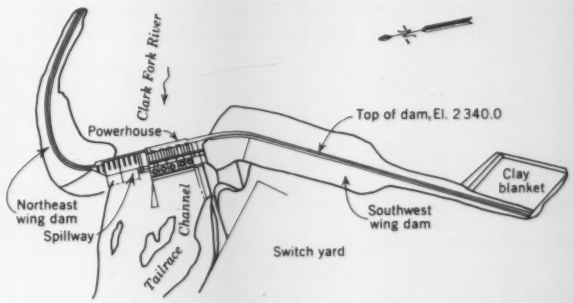



**FIG. 2. Noxon Rapids Dam consists of four main parts—two earth-fill wing dams, concrete spillway overflow section, and concrete non-overflow powerhouse and intake section.**

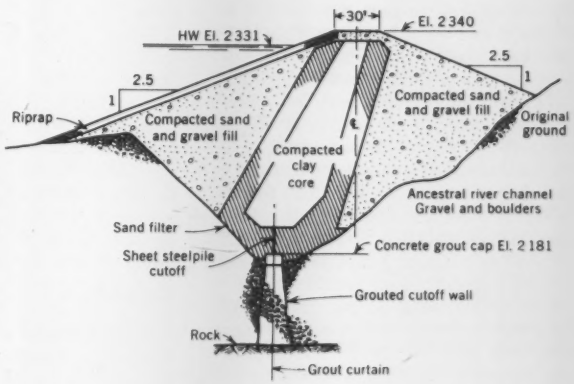



**FIG. 3. Section through Northeast Wing Dam shows cutoff wall 200 ft long provided by grouting existing sand and gravel in place. Steel sheetpiling extends cutoff into clay core.**

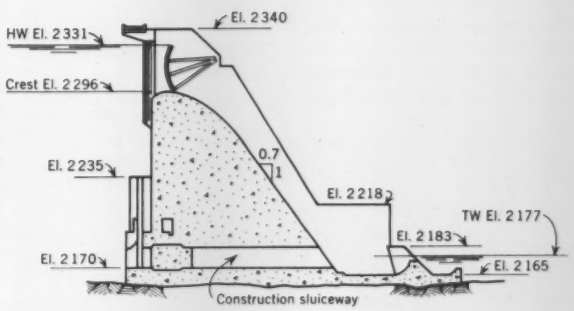



**FIG. 4. In section through concrete spillway and apron, note construction sluiceway. Eight of these low-level sluiceways, each 12 x 17 ft, carried normal river flow during construction.**

**Interlocking steel sheetpile wall was set on a grouted cutoff, as shown in Fig. 3, to tie into the compacted clay core of the earth dam.**

**Francis turbine of 233-in. diameter, manufactured by Allis Chalmers, was shipped in three pieces, which were joined at the site in a 230-in. shrink ring.**

—used to fortify the underlying clay stratum upstream and thus minimize percolation.

### Grouted-gravel cutoff

A well pronounced ridge of rock extends from the north end of the main dam approximately parallel to the river; it is covered in part by over 100 ft of gravel and some boulders. This high rock was selected as a seat for the impervious core of the northeast wing dam and excavation was arranged accordingly. For a length of about 200 ft of the 1,800 ft of this dam, the rock was deeper than river level, in the form of a buried channel. This gap had to be closed by some method other than the use of a core wall. Sheetpiling could not be used because of boulders; freezing was too expensive and too slow.

The method adopted was grouting of the gravel to form in effect a submerged core wall. (See Fig. 3) The excavation was carried down to El. 2174 and a concrete slab 8 ft wide and 5 to 7 ft thick was placed as a working platform. Holes were staggered on about 2-ft centers through the concrete with additional angle holes at each end. Some 13,000 ft of drilling and 33,000 ft of redrilling were done.

The grouting was done in stages from the top down, the stages varying from 5 to 10 ft or more in height. Neat cement mixes were used and the ratio of water to cement varied from 4:1 to 2/3:1. About 13,000 sacks of cement were used in grouting about 5,180 sq ft. The average wall thickness is about 8 ft. Many drill holes were tested with water up to 65 psi; any hole that leaked more than $\frac{1}{10}$ gal per min per lin ft of hole was regrouted and again tested. It is estimated that this criterion would correspond to a coefficient of permeability of $5 \times 10^{-5}$ cm per sec, which would be acceptable for the core of an earth dam.

When the grouting was completed, a wall of interlocking steel sheetpiling 24 ft high was erected on the concrete slab and sealed with a rubber compound. Backfill of sand and gravel was then placed to within 10 ft of the top of the sheetpiles. On the backfill 5 ft of compacted sand filter was placed. A clay core was put in from this elevation to the top of the wing dam or embankment.

### Largest Francis turbine runners

Some features of the power equipment are of special interest. The Francis turbines, rated at 130,800 hp, and guaranteed at a 152-ft head, have an expected output at that head of 137,800 hp. The speed is 100 rpm and thus the specific speed number at the guaranteed output is 68, appreciably higher than current practice. This speed was developed after an extensive series of model tests by the manufacturer, Allis-Chalmers Company, lasting over a year. The runners are among the largest of their type in existence, having a maximum diameter of 232.85 in. and a height of over 10 ft. (See "Big Equipment Sets the Pace in Race for More Power," by R. A. Sutherland, F. ASCE, CIVIL ENGINEERING, October 1955, vol. p. 636.)

Shipping limitations required that each of the runners be shipped in three parts. The shrink bands, 229⅝ in. in diameter and 42 in. wide, were shipped in one piece. After the runners had been assembled in the field by bolting, the bands were heated to expand them, shrunk on, doweled and welded, after which the bolts and lugs were removed and ground down so as not to obstruct the water passages.

Another unusual feature of the turbines is their welded T-1 steel spiral cases, among the first ever built. They were fabricated and erected by Chicago Bridge and Iron Company and are described by E. L. Seeland in the October 1957 *Journal* of the ASCE Power Division, Paper 1398.

The 325-ton capacity and 73-ft span of the powerhouse gantry crane is impressive although not record breaking. The design is a somewhat unique "rigid frame," with space between the legs left open so that loads picked up at the ends of the 111-ft-span bridge can be carried through the legs to the deck. The "yokes" at the top serve to tie the legs together without interfering with the travel of the hoist trolley. The crane can thus handle the draft-tube gates from the downstream extension and the transformers from the upstream extension.

Concrete was topped out in December 1958 and the pool filled from spring flood flows. Current activity is concentrated on the powerhouse to get energy on the line in September.

# An electronic break-through in surveying

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Department of Mines and Technical Surveys
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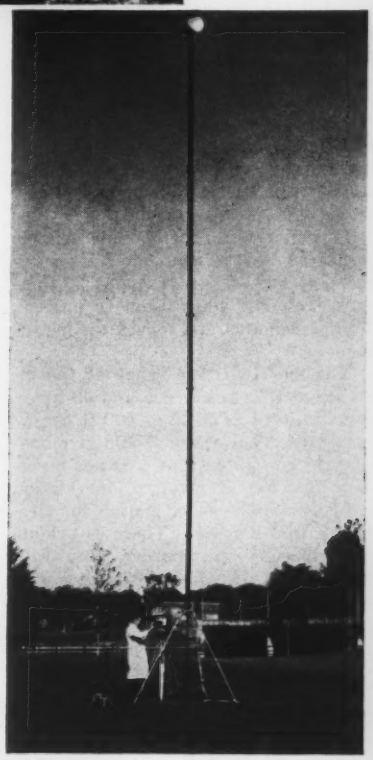
Topographical surveyors in the Quebec-Labrador iron-ore region wait for their helicopter to land. A triangulation point is marked by a prefabricated magnesium alloy signal, which can be sighted from other ground stations. Photo, National Film Board of Canada.



Canadian surveyors devised a telescoping antenna to lift the parabola of the Tellurometer up to 40 ft above the instrument and thus permit the micro-waves to clear obstructions, ground swells and brush between the master unit and the remote one. This innovation eliminates the need to build towers. Photo, National Research Council (Canada).

Canada's huge job of mapping the entire country to a useful scale is being aided greatly by electronics. For years, the Canadian Department of Mines and Technical Surveys has been engaged in establishing a network of surveys across the length and breadth of the country, including the vast sweep of unmapped islands under the Arctic Circle.

Twelve years ago a concerted effort was launched to complete the mapping of the rough mountain ranges and prairies spreading hundreds of miles into Canada's uncharted northland. Our first objective was to map all of Canada to the scale of 1/250,000. The field work for this phase is 60 percent complete. Our second objective was to map the already settled areas at 1/50,000. This stage also is well under way.

Into this comprehensive program of establishing vertical and horizontal control for mapping, electronics has made a rather dramatic entrance. This has been accomplished by the development of a radar-like distance-measuring system, utilizing micro-waves to determine the precise distance between two stations. The innovation has given new impetus to our field work and an accuracy that easily satisfies most survey requirements. It introduces a basically new method of measuring distances.

## Measurement by micro-wave

Because distance determination by electronics is new to the civil engineering field, some background explanation may be useful. A device called the Tellurometer invented by Mr. T. L. Wadley, a scientist on the staff of the South African Council for Scientific and Industrial Research, employs micro-waves

to give surveyors the precise distance between two stations. A set of the equipment consists of two portable units, one placed at each end of the line to be measured, each powered by an ordinary automobile storage battery. Operators, sometimes out of sight of each other, maintain contact by means of built-in radio telephones.

What the Tellurometer actually measures is the *time* taken, in millimicroseconds ($10^{-9}$ sec), for a radio wave to travel from a "master" to a "remote" unit and return. Since the velocity of wave propagation is known, surveyors can easily convert this finding into distance, by a fairly simple calculation.

The electronics involved is simple. A continuous wave of about 10 cm in length—3,000 Mc (megacycles) per sec—is radiated from the master unit. This carrier wave is modulated by measuring frequencies of 10 Mc per sec and others of similar order and is received and reradiated by the remote unit. The return wave is intercepted by the master unit and the phase shift between the outgoing and incoming modulations is indicated by a cathode-ray tube. This phase shift gives the measure of elapsed time and is indicated by a small break in a trace adjacent to a circular scale. Four measuring frequencies are used and the same scale serves for all. For the sake of simplicity, the velocity of propagation used in the computation is half the actual value, so that the distance is deduced directly.

The velocity of the micro-waves varies a little with atmospheric pressure and humidity, and small corrections must be made for these variations. Therefore the operator carries a wet-and-dry-bulb thermometer and a barometer for measuring these meteorological conditions.

### Canadians pioneer in survey

Canadian surveyors pioneered in the field testing of this new system of distance measurement. We first tested the Tellurometer against a very precise 10-mile line. It yielded agreement within 6 in. Another "shot" of 13 miles in the same series agreed within one part in 100,000 with the precisely computed geodetic distance. Measurements were made along railroad tracks, over water, among trees, under power lines, and at other unusual locations to determine the limitations of the electronic system. The Tellurometer proved sufficiently dependable to warrant equipping crews headed for the isolated northern areas with the portable instruments.

Up in the Northwest Territories, Tellurometer field crews used the electronic system for establishing mapping control from Lake Athabasca to Great Slave Lake. Trees were cleared where necessary and many angular measurements made in advance. Within 20 working days, 98 distance measurements were made, varying from 3 miles to 35 miles in length. On one day, the crew's measurements totaled 130 miles.

A party of two engineers, three student assistants, and a cook ran 1,068 miles of survey traverse (including side shots) over the Alberta and Saskatchewan prairies. Equipped with a one-ton stake truck, a panel truck, a kitchen trailer and a jeep, this crew traveled 32 miles a day, setting about 7 stations per day.

Another crew was assigned the task of running a traverse 250 miles northward through Ontario, partly along a railroad line. Here the party ran into trouble. First, the instruments were jarred excessively day by day while being transported to and from the field on track cars, and second, the railway intercommunications interfered with measurements and forced delays. Nevertheless this traverse was completed in good time and closures were satisfactory.

The technique of measuring lines with micro-waves, we found, was extremely simple and required no knowledge of electronics. Competent engineers and surveyors learned to produce useful work after a training period of a week. After a small amount of on-the-job experience, our men became reliable operators, able to complete a measurement at one station in about 20 minutes, including time taken to unpack, set up, demount, and repack the instrument.

The most effective range of the instrument falls between 5 and 40 miles, but distances as short as 500 ft can be measured. The terrain should give line-of-sight conditions, but it is not necessary that the operator at one station actually see the other station for electronic measurement. There is seldom any difficulty in pointing, even with zero visibility, because the beam is wide enough (about 10 deg) to allow the operators at the two stations to locate each other from an approximate knowledge of the direction. Once they establish contact, they can make more precise pointings by observing the strength of the signals.

Haze, fog, or even light rain seem to have no adverse effect on the readings. Very large objects moving across the beam can interfere with the measurements. Stationary obstructions in midpath have no effect unless they are large enough to cut off a considerable fraction of the beam, which is very wide in that area.

Reflection of the radio waves from ground surfaces sometimes sets up a condition known as "ground swing," which may be great enough to affect the accuracy of the readings. Fortunately, surveyors can tell from an examination of the readings when this condition is present and can compensate for it by taking a large number of sets and establishing a mean. For mapping and similar surveys of lower order, we usually take only three sets, unless it is suspected that large ground swing is present.

Angle measurements, necessary in traversing with the electronic system, present no new problems, the only significant change being in the type of theodolite used. Before the advent of the Tellurometer, a *minute*-reading instrument was used and the resulting accuracy of angular measurements was commensurate with that of the distance measurements. With the increased precision of Tellurometer-measured distances, however, a corresponding increase in angular precision is needed.

For this reason, a *second*-reading instrument is used on Tellurometer operations. Angles are usually measured immediately before or after the distances, the same tripod being used for both theodolite and Tellurometer. The procedure is the same as in low-order triangulation, six pointings being made—three in the direct position and three with the instrument reversed.

### A traverse of 2,700 miles

Our most successful application of the technique was on the Ungava Peninsula, where Canadian surveyors established control throughout a vast tundra area of 70,000 sq miles. Here, two two-man crews measured 2,700 miles in 38 working days—an average of 71 miles a day. Such a task would have taken two full field seasons by the triangulation method we first planned to employ. An estimated saving in cost of $160,000 was realized by use of the Tellurometer on this one project alone.

The "party" consisted of 19 men—chief, traverse crews, barometric leveling crew, air crew, mechanics, cook, office crew (who performed preliminary computations, daily check of field notes, etc.), and laborers. It was but a small part of this force, the two traverse crews, who measured the 2,700 miles.

This was barren tundra country; its center was 500 miles north of the nearest railhead and 800 miles north of the normal air supply points. The summer working season is short and the party had to work its way through unknown regions for weeks while supplies were flown in. The major problem proved to be that of keeping the camp moving with the surveyors. Two Bell helicopters were used to transport the surveyors down the traverse and two Beaver

aircraft for supplying and moving camp. Thus the operation was a good test of the instrument's ability to withstand hurried and sometimes rough handling.

These surveys were tied to geodetic points; established earlier by shoran, and run in loops, the largest of which was 960 miles. Some 271 distances were measured, the average length of line being 10 miles.

On the actual traversing, a complete crew consisted of two surveyors, with one helicopter for transport. Before beginning the traverse, the air crew set out a supply of prefabricated magnesium signals, of the type used in triangulation, at strategic points along the route. No reconnaissance was necessary. The helicopter moved the survey crew forward along the traverse in leapfrog fashion, bringing the rear man forward past the leading man to a new station and then returning to the other surveyor, who had become rear man.

Arriving at the new station, the leading man set up his Tellurometer, established voice contact with his partner at the rear station and, in cooperation with him, made the distance measurement. He then erected the signal and set the station marker.

The station marker consists of a bronze plaque cemented into solid rock and marking the precise position of the coordinated point. The signal (for this operation) consists of a magnesium alloy tripod with a cloth skirt. Its purpose is to act as a sighting mark when the station concerned becomes "the preceding" (see next paragraph) and is not occupied by a surveyor with the instrument. The skirt is high enough so that a Tellurometer or transit can be set up under it and measurements made with the signal in position.

Meanwhile, the rear man, when he had finished with the distance measurement, removed the Tellurometer from the tripod and replaced it with the transit. He measured the angle between the preceding and succeeding stations to establish the traverse. By the time he had finished this task, the helicopter had returned to move him forward. At the end of the day's work the surveyors covered their equipment with tarpaulins and left them in the field so that they could both return to camp in one trip of the helicopter.

Helicopters and small aircraft have proved invaluable in such projects. A combination of Tellurometer and helicopter has enabled parties to run up to 132 miles of traverse in one day.

### A Canadian innovation

Canadian scientists have modified the instrument to make it more suitable for our purposes. For example, there are large areas of Canada where the timber growth is dense but not very high—20 to 40 ft. To measure distances with the Tellurometer through this forest cover, surveyors would have to build towers at every station or clear very wide lines. The device cannot "shoot" through very narrow lines as a theodolite can. The wide beam of the radiated wave would intersect the timber a few feet from the antenna and the reflections would hopelessly vitiate the results. If the stations are on the tops of pointed hills, as is quite usual, this requirement of wide lines is not serious, since the openings needed will be very short and most of the hilltop will be cleared off in any event.

To avoid the necessity of clearing line between stations in flat terrain, Dr. A. G. Mungall, of the Division of Applied Physics, National Research Council, devised a means of separating the antenna, the actual source of the radiated wave, from the main body of the circuitry and elevating it on a mast so that the instrument can "see" over the tops of the trees. The retracting mast can be run up as high as 40 ft above the instrument. The crews can then clear the usual line, a few feet in width, for sighting purposes, and the distances can be measured over, rather than through, the timber.

One party ran a 140-mile traverse over ice along the shore of Lake Athabasca to establish control for 1/50,000 mapping. This survey gave an opportunity to test the detached antenna, but for a purpose different from that just described. Reflections from the ice surface caused so much interference that the Tellurometer would not work when set up in the normal position. The surveyors then tried extending the antenna about 12 ft above the instrument.

Results were gratifying. Because of the increased height, the radiated wave was much wider where it met the surface and was sufficiently diffused to permit good readings. Although the average length of lines measured was only about three miles, the accuracy obtained was quite acceptable for topographical purposes.

The elevated antenna was used extensively here. To obtain the angles, it was necessary to clear long lines of sight between stations over country that is flat and covered with a growth of small timber. It would have been impossible to measure the distances along these narrow lines with the unmodified Tellurometer, but there was no difficulty when the antenna was extended to transmit above the treetops.

### Advantages of the traverse

Canadian surveyors at first thought of using the Tellurometer to survey by trilateration. In a sense this is the converse of triangulation since all the sides of the geometrical figure are measured and the angles calculated. It was soon realized, however, that this would be to sacrifice most of the advantages of the instrument, and this idea was abandoned in favor of traversing.

For trilateration, as many stations would be necessary as for triangulation and sometimes more; computations would be as laborious as in triangulation; many wide lines would have to be cleared, or towers built, in wooded country; more astronomic observations would be required because of rapid deterioration of azimuth; more transport would be necessary; and there would be little if any saving in time.

In traversing, by contrast, the number of stations and the amount of transport and line clearing are all kept to a minimum; azimuth can be maintained as well as in triangulation; computations are greatly simplified; and reconnaissance is curtailed in all types of operation. In some cases, such as in the Ungava operations, reconnaissance could even be combined with the distance-measuring and angle-measuring operations, so that each station had to be visited only once during the whole survey.

In some flat or gently rolling country with large timber growth, the labor involved in clearing lines of sight or building towers, for either traverse or triangulation, is very great. It is possible that trilateration with the extended antenna will prove to be the most economical method in these areas, and this possibility is now being investigated.

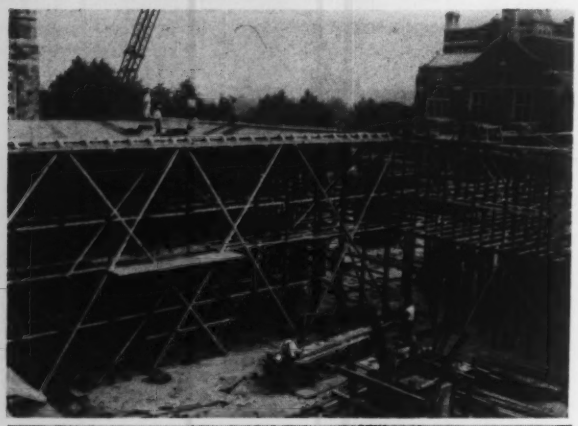
### Time and cost savings

No exact figures on savings in cost due to the use of the Tellurometer are possible, but the following facts are revealing. Savings on two major operations of the Topographical Survey in 1957, using three sets of the equipment, are estimated to be in the neighborhood of $200,000. This is somewhat more than twice the cost of all eight sets now in use by the Division, with all auxiliary equipment.

Time savings on most operations are estimated to be better than 50 percent.

The Tellurometer is the first piece of equipment using electro-magnetic waves to be placed in the hands of the surveyor, and its full capabilities have not yet been realized. Surveyors new to micro-wave measurement should understand the principles involved. Otherwise there is danger of using the device for purposes or under conditions it was not designed to meet and thus doing damage to the quality of the work, as well as to the reputation of the technique.

Shores were placed 2 ft apart beneath wales on 4-ft centers. The 2 ft x 8-ft plywood sheets were nailed to joists spaced 2 ft apart. In lower view, a welded mat made of steel bars is lowered into position. The reinforcing mats, 10 x 30 ft, were shipped to the site and placed on the forms by a four-man crew. No labor for splicing, tying or bending was required at the site. Photos, Wire Reinforcement Institute.



# INVERTED CONCRETE UMBRELLAS

## *for the roof of a college library*


**MAURICE BARRON, F. ASCE**

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New York, N. Y.

**L. D. Long,** President

Gulick-Henderson Laboratories, Inc.

Flushing, N. Y.


A structure of unusual design is approaching completion at Hunter College in the City of New York. A library, whose thin-shelled roof consists of six 60 x 60-ft inverted concrete umbrellas, supported by six concrete columns with a cross section in the form of a Roman cross, is expected to be ready for occupancy by late 1959. Concreting of the 120 x 180-ft roof was carried out early last fall. The consulting engineers, Farkas & Barron, with economy in mind, overcame problems dealing with both materials and plastic flow.

Plastic flow, if not taken into account, would have caused sagging of the corners of the unsupported cantilevers of the shell. The result would have been an unsightly appearance and cracking of the all-glass walls of the building. This problem has arisen on many other hyperbolic paraboloid buildings, whose cantilevered roofs have sagged in places, particularly at the corners unless supported at least partially by masonry walls. Engineering literature does not disclose the ex-

tent of the deflections from this cause or indicate how much a roof should be cambered to avoid the difficulty.

On the Hunter College building a simple and relatively inexpensive way was found to prevent sagging of the cantilevered roof from plastic flow. This was to use heavy-duty mullions which serve the dual purpose of framing the windows and preventing sag.

The simplified procedures worked out for construction were so successful that each of three successive shells were built in half the time required for the preceding one. Many of the problems involved might have led to considerable expense or even disaster if not foreseen and solved in the office and in the field.

### Simplified formwork

One problem was the design of the forms for economy in first cost, maximum reuse, and ease of stripping. The shape of a double-curved hyperbolic paraboloid surface is found in space by the translation of a straight line as generator guided by two other straight lines. This makes it possible to use straight lumber for formwork supports. The outer edges of each umbrella are straight horizontal lines, 23 ft above the floor elevation. The center of the umbrella is just 10 ft above the floor at the column. A straight member slopes from each column to the center of each 60-ft edge. Thus all elements of the surface parallel to the 60-ft edges are straight lines in space.

It is along these straight lines that the formwork joists were constructed on 2-ft centers with wales on 4-ft centers. The formwork was designed to be stripped out from under the shells when the concrete reached a strength of 1,200 psi, obtained in three days. Reshoring was immediately installed.

Great economies were realized by using rectangular 2 x 8-ft plywood sheets for the form surface. These were warped and nailed to the straight form joists. Since each 30 x 30-ft paraboloid is trapezoidal along its double curved surface, wedge-shaped panels would have been required to cover the surface completely. Instead, long thin wedge-shaped spaces were left along the 8-ft side of each panel. These spaces were allowed to fill with concrete, forming fins across the entire lower surface of each of the four quadrants of the umbrella, parallel to its edge.

The fins run in different directions on each quadrant, forming an interesting pattern of lines on the under side of the roof, which is left unpainted for economy and esthetic reasons. Although 4 x 8-ft plywood panels could have been used uncut, they would have been harder to warp and would have left a broader fin.

Another problem was how to fabricate and place the reinforcement for the shell with maximum economy. Most of the reinforcing consists of a new type of welded mat made up of large-size bars of cold-drawn steel. These smooth round bars were prefabricated into 10 x 30-ft mats, which were shipped to the site and placed directly in the forms without additional labor, such as for splicing, tying or bending. For five of the umbrellas, bars of No. 5/0 gage (0.43 in. in diameter) were used, spaced 6 in. on centers. When placed, the mats were overlapped one bar (6 in.) to develop the strength of the steel without the need for mechanical splicing.

This is one of the first major uses of bars in mat form in a building. They are now available in any spacing and bar size up to ½-in. diameter. Similar mats are now being used by Farkas & Barron in a design for a reinforced concrete flat-plate high-rise apartment building. Since the mats come to the job in flat sheets, they can be hoisted by a crane and positioned directly on the chairs above the formwork by only four men. Considerable labor is saved by this procedure.

The mats were placed on 1-in. chairs. Because of their weight, they draped perfectly along the curved contours of the roof, eliminating the need for tying. This natural draping resulted from the proper combination of bar size, spacing, and overall mat size, as became evident when, on the sixth shell, a bar of smaller diameter was used. Two mats made up of bars of No. 0 gage (0.30-in. diameter) did not drape along the shell's contours and therefore required tying and "hold-downs."

The four hyperbolic paraboloid quadrants are joined by compression ribs which bisect the umbrella in two directions. These are 5 ft 4 in. wide, varying in depth from 8 in. at the top of the shell to 14 in. at the low point over the column. Rib reinforcing is provided by four No. 8 and six No. 5 bars with No. 3 ties. The ribs transmit the shell loads directly into the columns below. In cross section, these columns are in the form of a Roman cross; each stem of the cross acts as a continuation of the rib above. The vertical reinforcing within each column consists of 32 No. 11 bars and 12 No. 8 bars; column ties are No. 4 bars spaced at 12 in. The thickness of each of the stems of the cross is 14 in. and its width is 4 ft.

Extra reinforcement along the outside edge of the shell resists the membrane shear stresses. At the extreme edge there is a wedge-shaped section of concrete that contains seven No. 8 bars in tension. It is 13 in. wide and 4 in. deep on one side, rising to a height of 8 in. at the outside edge of the shell.

### Concrete cast on steep slope

Since New York City's building code classified the structure as a slab, a 3½-in. thickness was required. A much thinner shell—only 2 or 2½ in. thick—would have been adequate if designed in accordance with modern shell theories. To offset the weight penalty of the thicker shell, lightweight concrete was used.

Specifications called for rapid

**Concreting was started at the north quadrant of the first unit and carried out counterclockwise, beginning at the highest part of the upside-down umbrella, at its outer edge, and proceeding downward to the low point over the column. Here workmen can be seen placing concrete at the top of the second segment.**

strength gain in the Lelite (lightweight) concrete, so that the forms could be stripped early and reused. Also, a low water-cement ratio was a "must," as only a 2-in. slump was permitted to prevent the mix from running down the sloped roof. The slope was as steep as 45 deg near the columns and averaged 36 deg elsewhere. Plastiment retarding-densifier, added to the concrete, provided the required low-slump workability. The Plastiment concrete remained stable on the slope without sliding because of its rapid clear-water bleeding characteristics.

Strengths of 3,000 psi were obtained in 7 days, making early form stripping possible, and a strength of 4,000 psi was obtained in 28 days for this lightweight concrete. Specifications called for a 28-day strength of 3,500 psi. The admixture aided in achieving a high compressive strength without using a high cement factor, thus keeping the drying shrinkage to a minimum.

Each 1-cu yd batch of concrete, weighing 114 lb per cu ft, contained:

640 lb of cement (6.88 sack mix)
1,100 lb of sand
965 lb of ¾-in. Lelite aggregate
41½ gal of water (5 gal per sack of cement)
3½ lb of Plastiment retarding-densifier, (½ lb per sack of cement)
An air entraining agent

Lightweight mixes are frequently harsh because of the shape and angularity of the aggregate and are therefore difficult to place and work. Adding fines to the mix usually helps to improve the workability—but only within limits. Internal lubrication was needed —and furnished by the inclusion of the retarding-densifier, which was especially important because relatively little water was permitted on this job. Air entrainment also helped reduce the harshness of the mix.

Each of the six umbrellas was cast separately in an alternating pattern. Concreting started at the north quadrant of the first unit and was carried out counterclockwise, beginning at the highest part of the upside-down umbrella, at its outer edge, and proceeding downward to the low point over the column. The steep slopes made such a procedure mandatory from the point of view of placing and finishing the slab. The first quadrant required 2½ hours to concrete. Thereafter the work went faster as the 14-man crew gained experience and ready-mix concrete deliveries were accelerated. By noon, about 60 percent of this first umbrella had been placed, screened and finished.

The retarding-densifier kept the concrete, cast before lunch, from setting. Rapid bleeding after placement further reduced the slump, enabling the unset concrete to remain on the steep slope without sliding down. When work was resumed in the afternoon, the fresh concrete was revibrated into the material placed earlier. The same technique was used to join the last strip of concrete to the first one, placed six hours earlier.

Some problems arose when gasoline power vibrators were first used, since the vibrations were transmitted through the entire reinforcing system, causing undesirable movement of the partially set concrete. This difficulty was easily overcome by mounting the vibrator in a sling, which dampened the vibration.

### Stripping

Within three days after placing, the membrane forms were stripped out. Cylinder tests by the Gulick-Henderson Laboratories showed strengths of 1,200 psi. Swiss hammer readings taken during the course of the job checked the cylinder tests within 5 percent.

After the membrane forms were stripped, the Acrow jacks were reshored to an 8-ft spacing under the edge of the shell and under the ribs. These were left in place for 28 days and then released. A carefully planned sequence was followed in removing these shores, and the resulting shell deflections were recorded.

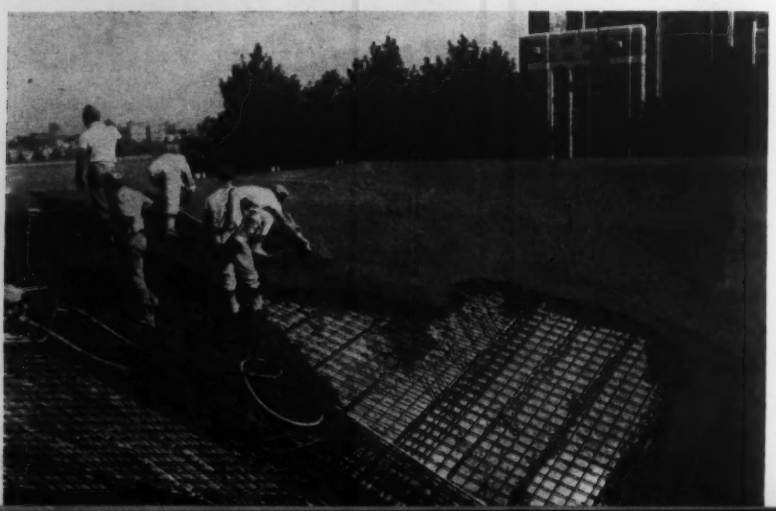
Starting at one outermost corner, where the shell rigidity is at a minimum, the first shore was released. Then alternate shores were removed, first along one side, then along the adjacent side. The deflections resulting from the release of the shores, spaced at 8-ft intervals, were recorded. When the ribs at the midpoints of the umbrella were reached, the shores were removed one at a time along the entire length of each rib, from the outer edge toward the column. It took two hours to release all the jacks. By that time, the corner had deflected ½ in.

The measured elastic deflections checked almost exactly with those calculated. The latter amounted to approximately 0.9 in. at the exposed four corners of the roof. In calculating them, the consultants first used conventional shell theories, but the results appeared unrealistic. The final deflections used as the basis for the design were arrived at by considering the combined live-load and dead-load effects—from shear and from bending of the shell. The deflections of a curved cantilever beam were calculated using Castigliano's theorem of least work, considering the shell as a curved cantilever.

### Plastic flow prevented

A source of possible deflection at the corners from plastic flow was prevented by providing vertical support in the window mullions that ring the entire 600-ft perimeter of the library. The mullions, spaced 6 ft on centers, are

**Concrete-shell surface is being finished. Rapid bleeding of the 2-in-slump concrete aided in holding it on the steeply sloping roof.**



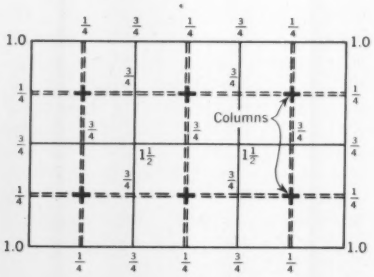



**FIG. 1. Camber, in inches, is indicated on plan of hyperbolic paraboloid shells for roof of Hunter College Library, New York. The consultants predict that the interior corners of the shells, now cambered 1½ in., will deflect to a level position in 3 years and will deflect another 1½ in. by 1964, from plastic flow.**

8-in. H-sections. They are strong enough to withstand any loads resulting from plastic flow over the years, although they carry no load now. Elastic and plastic effects are of great importance in a building of this type. Unless controlled, they can crack the windows. As an extra precaution the windows are supported at sides and bottom only, without any contact at the top.

The edges of the shell are cambered, to offset the effects of elastic and plastic flow along the periphery of the building and at the two interior points where four shells join. Here the unsupported shell corners are cambered 1½ in., as shown in Fig. 1. Experience leads the consultants to believe that these two corners will be approximately level after three years, as a result of plastic flow. Thereafter there will be some additional sagging until, by 1964, the two interior corners will be approximately 1½ in. below the level position. On the inside, the deflections from plastic flow will not be noticed, as there is no line or point of reference by which they can be measured. From the outside, however, deflections would be noticeable at the corners of the umbrellas, which would sag without the H-mullion supports. The 3-in. Perlite insulation that covers the concrete will deflect with the shell, and the roofing felt is also flexible.

### Design features

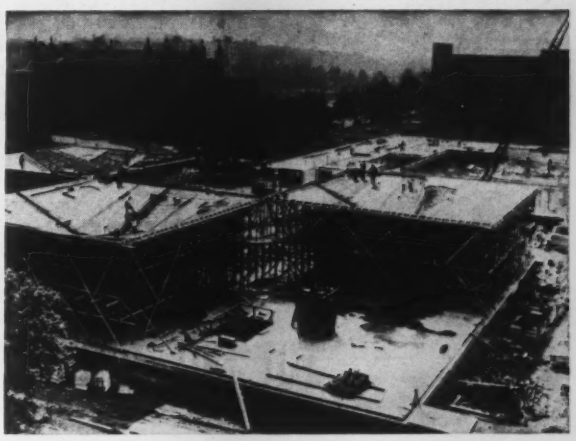
Using standard shell theory, it was calculated that the deflections for the umbrella at the outside corners of the quadrants would be as follows: From membrane dead load, 0.03 in.; from bending, 0.27 in.; and from plastic flow, 1.00 in., giving a total of 1.30 in. In the Farkas & Barron calculations, the membrane dead-load deflection was omitted; 0.90 in. was used for bending; and plastic flow was neglected, since the structure is considered to be restrained so that plastic flow will be controlled. The bending deflection for dead load, as actually measured, checked the computed deflection within 5 percent.

The concrete roof is designed to withstand a dead load of 50 psf and a live load of 40 psf. Calculations indicate that a theoretical live load of 230 psf would cause failure of the shell. Thus the factor of safety is about 6. For calculation, the loading was considered on a horizontal projection of the roof; the slope increases the stress by less than 5 percent. The stresses were calculated using Poisson's ratio as 20 percent and the value of $E$ as 2,262,000 psi.

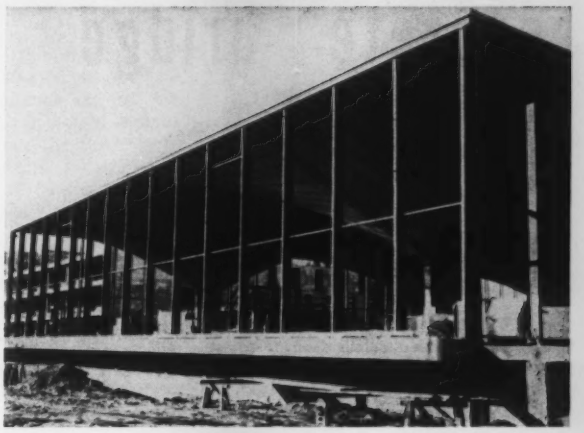
Unusual loading problems were considered, such as the possibility that water may collect in the depressed area over the drain pipe and freeze. Additional layers of ice might increase the dead load and cause large stresses in the shell and column. To meet this danger, the drain pipe, of 8-in. diameter, is extended 4 ft above the low point of the roof and perforated along this length, so that if water should accumulate above ice, it could drain off through the upper holes.

Since the roof of this structure is visible from other campus buildings, it will be a regular maintenance responsibility to keep the shells from filling up with rain or snow. The shell is strong enough so that it would not be overstressed if one-third of its height should fill with water. Even if the umbrellas should become completely filled with water or ice, the roof would not collapse. Taken into consideration, also, was the possibility that only a few of the umbrellas might fill up, causing an unsymmetrical loading condition and bending in the columns. Therefore the columns were designed to withstand such a loading, as well as an unbalanced wind load or snow load.

The main floor is of two-way reinforced-concrete "pan" construction with a basement beneath. The rest of the structural system is of conventional design and construction, as are the footings.



**Concrete on roof of first unit (right), of Hunter College Library, Bronx, N. Y., remains plastic during lunch break as a result of the inclusion of Plastiment retarding-densifier in the mix. Workmen place steel on second of six roof units (left foreground) and complete formwork on third unit (left rear) for the 120 x 180-ft building.**



**Library of unusual design takes shape on the Bronx, N. Y., Campus of Hunter College. The thin-shell concrete roof of the structure consists of six sections shaped like inverted umbrellas. Columns with a cross section in the shape of a Roman cross support the umbrellas. Occupancy of the $3,300,000 building is scheduled for late 1959.**

The Structural Consulting Engineers are Farkas & Barron and the architect is Marcel Breuer & Associates, both of New York, N. Y. The architect is to be complimented on his imagination and daring in selecting such an unusual and dramatic shape for the Library. Gulick-Henderson Laboratories designed the concrete mix and supervised production of the lightweight controlled concrete. They also helped in recording deflections.

Concreting of the entire structure was carried out without difficulty and with a minimum of delay by the contractor, Dic Concrete Corporation, of Elmont, Long Island. Anthony Bertone is the Chief Engineer for the contractor, who worked closely with Richard Guilmenot, Job Superintendent, in resolving many construction problems.

Jerome Furst is the Resident Engineer for the owner, the Board of Higher Education of the City of New York. The general contractor is Leon D. De Matteis & Sons, Inc., of Elmont, Long Island. Ryan Concrete Company furnished the ready-mix concrete.

# A new steel backbone for an old concrete bridge

**D. E. STEVENS, M. ASCE,** Regional Engineer

American Institute of Steel Construction, Atlanta, Ga.

**Washington Viaduct in congested section of downtown Atlanta, Ga., was practically rebuilt in place, without interruption to traffic flow.**

**The problem:** Rebuild a 50-year-old, badly deteriorated viaduct, carrying an estimated 15,000 cars a day in busy Atlanta, Ga., with no interruption to traffic.

**Solution:** $450,000 + Engineering ingenuity

A serious problem arose recently when the Washington Street Viaduct, a bridge near the heart of the downtown area of Atlanta, Ga., reached the danger point of deterioration from fifty years of use. An engineering survey showed that time and repeated overloading had taken a severe toll of this structure. Its primarily concrete superstructure had crumbled badly and might not much longer be servicable.

Analysis showed that the most practical and economical procedure would be to tear the bridge down and build a new one. However, the lack of alternative roadway facilities dictated that it should be renovated—if at all possible—and kept open during repairs, because of congested traffic conditions. Traffic engineers for the city estimate that 15,000 vehicles cross it daily.

Robert G. Lose, F. ASCE, a consulting engineer of Atlanta, came up with a plan that would salvage the existing structure by virtually rebuilding it in place. His plan was to reinforce the old bridge with a structural steel frame, designed to carry the full load, under each of the 26 concrete spans. This plan, supplemented by a design and details prepared by W. R. Walker, the city's bridge engineer, was adopted. Reconstruction was completed without at any time closing the bridge to regular traffic.

Traffic is heavy, not only on the viaduct, but beneath it as well, since it spans city streets, railroads and a busy warehouse area. This means that many special problems were encountered during the reconstruction work, and many ingenious techniques, tailored to the job, were developed to solve them.

The Washington Street Viaduct, built originally in 1907, begins near the municipal auditorium, carries traffic over Decatur Street, over the Georgia Railroad tracks and terminates at the State Capitol in downtown Atlanta. (See accompanying aerial photograph.) Although primarily a concrete structure, it does contain two steel sections —a plate-girder span of 64 ft 10 in. over Decatur Street, and several spans over the Georgia Railroad tracks, including a through truss, a plate girder, and several beam spans. That part of the bridge now being repaired begins just north of the Georgia Railroad tracks and continues northeast for about 700 ft. Spans, beginning at the railroad, are as follows:

| | |
|---|---|
| Two at 21 ft 0 in. | One at 64 ft 10 in. |
| Two at 32 ft 0 in. | One at 27 ft 8 in. |
| One at 33 ft 0 in. | Ten at 30 ft 0 in. |
| Four at 30 ft 0 in. | One at 21 ft 6 in. |
| One at 27 ft 7 in. | |

All these spans are of concrete beam-and-girder construction, with the ex-

ception of the 64-ft 10-in. plate-girder span over Decatur Street. Transversely the stringer spacing on the concrete spans is as follows: Two at 6 ft 5 in. on one side, three at 4 ft 8 in. through the center, and two at 6 ft 5 in. on the other side. See Fig. 1.

Originally, the roadway was 40 ft wide but when the current work is completed, it will be increased to 45 ft by cutting down on the width of the sidewalks.

Severe spalling and disintegration of the concrete has been taking place for some time. Several major repairs have been made to the concrete stringers, and new ones have been added in some places—some within the past several years. Yet before its recent renovation, this bridge was in a very critical condition. There was practically no member that had not suffered disintegration to some extent. Reinforcing steel was completely exposed for the full length of the entire span on many of the stringers, since the soffits of the beams had completely fallen away. The steel spans also showed some evidence of corrosion, but were generally in pretty fair condition. Included in the work was the strengthening of the plate-girder span over Decatur Street to offset corrosion and provide for the added traffic load.

Over 823 tons of structural steel were furnished by the Ingalls Iron Works Company of Birmingham, Ala., for the strengthening and renovation of this bridge. At present the steel work is practically completed. Briefly the work consisted of building a new abutment on the Gilmer Street end of the bridge and strengthening 25 of the old supporting bents, including the construction of new foundations for them. A steel wide-flange stringer was placed from 1 to 4 in. below each existing concrete stringer and grouted to insure a full bearing. All field connections were made with high-strength bolts. Work yet to be done, as of early June, includes completion of the Decatur Street span, removal of the old cantilivered sidewalk, and the installation of a new sidewalk stringer, new sidewalk, new railings, and completion of a new 5-in. deck slab.

### Bent strengthening

Although there is some variation in dimensions and sizes, a typical existing supporting bent can be described as follows. It consists of two concrete columns, 1 ft 10 in. square, which rest on spread footings spaced 40 ft from center to center. Columns are tied together at the top by a concrete floor beam 1 ft wide. First, the bents were shored, then excavation for the new foundation was made to the required depth. Eight steel-pipe piles of 8-in. diameter were driven from 10 ft 6 in. to 13 ft 0 in. apart, four to a line, and with lines parallel to the center line of the roadway. The two lines of piling were centered on the old concrete columns. See Fig. 2.

An interesting technique was employed in driving the piling under the bridge. Approximately 5 ft of concrete was poured inside the steel-pipe piles at the bottom. Guy lines then positioned

**In driving steel-pipe piling for new footings (top), hammer operated inside pile, with inner wall functioning as lead. Piles were driven to 25-ton capacity each. On top of piles new spread footing for new steel columns is poured directly over old foundation (directly above).**

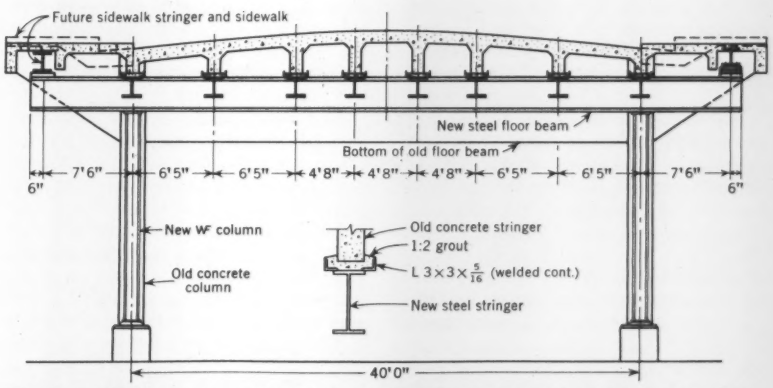



**FIG. 1. Typical transverse section through a bent of Washington Viaduct shows relation between old construction and new. Steel columns, floor beams and stringers were substituted for deteriorated concrete members. See column foundation plan, Fig. 2.**

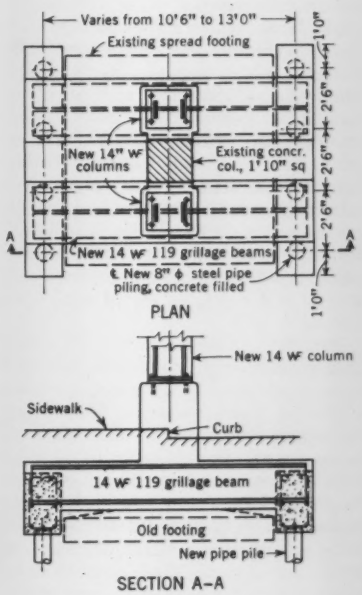



**Fig. 2. New foundation was provided for each supporting column, seen in plan and section. Old concrete column is flanked on each side by new 14-in. wide-flange steel column. Steel grillage beams were substituted for concrete grade beams where required by narrow clearance between top of old foundation and street level.**

New structural steel work is seen in place under one of the concrete spans. Note space (circled) in angles at midspan for wedging and grouting.

New structural steel columns, floor beams and stringers are seen in place in view looking toward new Gilmer Street abutment.

the pile and held it in place. The drop hammer used was a steel cylinder of 7¼-in. diameter, 8 ft long and weighing 1,100 lb. This hammer operated inside the steel-pipe pile, the walls of the pipe functioning as the driving leads. Piling was driven by this method until its top was far enough below the under side of the bridge to permit driving in the conventional manner. In all, 11,474 lin ft of piling was used.

Piles were driven until a value of 25 tons each was indicated, then filled with 3,750-psi concrete and capped with a continuous concrete grade beam. Wherever possible, these caps were tied together transversely with a concrete grade beam which supports the 2-ft-square pedestal on which the new wide-flange columns rest. In many cases, where the old footing was not deep enough to permit this arrangement, steel grillage beams, encased in concrete, had to be used. Two 14-in. wide-flange columns were used, one on each side of the existing column, a common center-line again paralleling the center-line of the roadway. Transversely these columns were the same distance apart as the old columns, 40 ft center to center.

Erection technique on the bents was also unusual, but again practical and tailored to the job. Two winch trucks, operating from the top of the bridge, with their lines threaded through holes made in the bridge deck, lifted each floor beam into place. While the floor beam was held in this position, the new columns were put in place beneath it. This is somewhat comparable to the technique of some South Pacific natives of building a house from the roof down.

A new steel stringer has been installed directly below each existing concrete stringer and frames flush-top into the new floor beams. See Fig. 1. As mentioned previously, these stringers were installed so as to allow a slight clearance between their top flanges and the bottoms of the existing concrete stringers. They were furnished by the fabricator with two angles, 3 x 3 x 5/16, welded to their top flanges, to serve as forms for grouting.

A crane, working under the bridge, was able to lift these stringers only high enough to support their ends on the top of the bottom flanges of the floor beams. Each end was then pushed upward into its final position by a front-end loader. This was rigged with a special vertical boom having a V-shaped fitting on the top.

The angles, with flange turned up, are continuous except for a 12-in. gap at midspan to allow for wedging. Steel wedges were used to transfer the load from the old stringer to the new one. They were 4 in. wide, 14 in. long and planed to a thickness of ¼ in. on one edge and ¾ in. on the other. Calculations were made to determine the amount of deflection in the steel beams necessary to pick up the dead load from the old bridge, and the wedges were driven in between the old and the new stringers at midspan until this deflection was obtained. Then, with the wedges still in place, grout was forced under pressure into the space between the old and new stringers.

The primary load-carrying members of the 64-ft 10-in. Decatur Street span are two steel plate girders 6 ft deep and spaced 40 ft center to center. Framing between these primary girders are the floor-beam girders, 4 ft 4¼ in. deep and spaced about 20 ft 6 in. on centers. Resting on the top flanges of the floor-beam girders are the 18-in. stringers.

### Plate-girder span strengthened

It was a relatively simple matter to strengthen this span. New angles, 2½ x 2½ x ½ and 25 ft long, were centered on the midpoint of the primary girders and field welded to the toe of the flange plates. Two new 18 WF 50 stringers were added on each side of the bridge, but the four existing stringers in the center of the bridge were left in place. These were found to be adequate —because of the center trolley load in the original design. New sidewalk stringers, brackets, and a deck slab will complete the job.

This was a particularly tedious erection job and those responsible for the design are to be congratulated on their careful attention to erection details. At virtually every connection there was plenty of room for error, and an oversight in such details as working room and driving clearances could have resulted in much expense and delay. There was no instance of such an oversight.

The work was executed by the Construction Department of the City of Atlanta. W. R. Walker, Bridge Engineer for the City, who designed the supporting structure, also developed most of the unusual construction techniques. Mr. Walker estimates that as of early June 1959 approximately $456,373 had been spent. Work on the concrete spans has been 95 percent completed and it is estimated that the Decatur Street span is 60 percent completed.

# The present crisis in civil engineering

B. A. WHISLER, F. ASCE, Head, Department of Civil Engineering

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Prominent people in engineering education are saying explicitly that civil engineering as practiced by most civil engineers today is not really engineering at all. They suggest that if we wish to continue to do the work we have always done, and which still needs to be done, we should admit that we are only high-class technicians and should abandon all right to the professional title of "engineer." This castigation is not applied solely to civil engineers but also to those engaged in industrial engineering, agricultural engineering, and many areas of mechanical engineering.

This is a serious situation and is resulting in pressures of a critical nature which are being brought to bear on engineering education. What is the origin of this crisis?

Modern developments in certain relatively narrow fields of engineering, such as atomic energy and guided missiles, are causing many leaders in engineering education to evaluate all such education in terms of the needs in these specialties. This can and will have a serious effect on the preparation of civil engineering students for professional practice unless civil engineers in general take an active part in combating this trend, which is undermining the professional status of practicing civil engineers.

Although most civil engineers may not realize it, their status as professional engineers depends to a great extent on the general philosophy toward engineering education adopted by the engineering colleges of the country. This is because registration as a professional engineer under state laws for all practical purposes requires graduation from an engineering curriculum accredited by the Engineers' Council for Professional Development. Therefore, if the accredited curricula in civil engineering do not train young men for the positions now held by professional civil engineers, such positions will be filled in the future by young men trained in non-accredited programs, who then will be virtually ineligible for registration as professional engineers. The positions will then automatically become nonprofessional. The question thus arises: Are the positions now held by registered professional engineers in the civil engineering field truly professional in nature? If they are, the civil engineering curricula must train young men for these positions.

The latest definition of "engineering," as approved by the Engineers' Council for Professional Development, appears in its 26th Annual Report for 1957-1958. It is as follows:

"Engineering is the profession in which a knowledge of the mathematical and natural sciences gained by study, experience and practice is applied with judgment to develop ways to utilize economically, the materials and forces of nature for the progressive well-being of mankind."

Older definitions of engineering always included the term "art" in recognition of the fact that, where scientific principles are lacking or are incompletely understood, the practicing engineer must and does make decisions that are not based on scientific analysis alone. This latest definition has dropped the word "art" but perhaps it does recognize that engineering decisions, particularly in civil engineering, can rarely be based on scientific principles alone. This may be inferred from the use of the terms "experience and practice" and "with judgment."

The present necessary emphasis on missile engineering, nuclear engineering and electronic devices for automation, computers and weapons has created a special need for the education of individuals who will be extremely capable in the mathematical and scientific aspects of these fields. These graduates will still be designated as engineers although it is quite possible that actually their training and work might better justify calling them scientists. Much of their work is purely theoretical in nature and many of them will have no personal part in the direct application of theory to the actual product, which is necessary in the strict sense of the title "engineer."

The romance and attendant publicity surrounding these activities have given individuals interested in these fields undue prominence in engineering education, particularly in the American Society for Engineering Education. As this society is undoubtedly the strongest single factor in the development of the accreditation procedures and standards of the Engineers' Council for Professional Development, ASEE influence on engineering education is very strong. We can have no quarrel with the development of appropriate standards in new fields of engineering, but such standards should not be applied indiscriminately in established fields where they are inappropriate.

The standards that are being applied to all engineering curricula, though inappropriate in many areas, may be broadly and perhaps somewhat cynically summarized as follows:

1. All engineers must be trained in mathematics beyond differential equations.
2. All engineers must study nuclear physics.
3. No technical course that does not make use of the calculus is appropriate in engineering training, nor should such a course appear in any engineering curriculum.
4. No field of endeavor that does not meet these standards in its educational requirements should be designated as engineering.

Many prominent people in engineering education are advancing the argument that civil engineers do a kind of work and make decisions that are not based largely on scientific principles but rather include a considerable element of the art, which can be learned only by extensive experience. They say that much of what is done in civil engineering design requires only the simpler aspects of mathematics, not even including the calculus, and therefore is not really engineering work. They suggest that we should abandon the title "engineer" so that those entitled to it will not have their dignity besmirched by our use of the term.

These critics seem to feel that it is undignified to apply scientific principles in the simplest possible way to the solution of the world's practical problems as engineers have traditionally done. They might better adopt a new term to describe their own particular activities instead of trying to change the definition of engineering as applied to others.

Specifically, the pressures on civil engineering education are to eliminate such courses as surveying, contracts and specifications, laboratories in concrete and asphalt, and highway safety and traffic control in favor of advanced courses in mathematics, physics, and other basic sciences. The civil engineer who enters the field of research needs advanced work in mathematics and science beyond that commonly given in the undergraduate courses, but he can get this training at the graduate level.

What is forgotten is that most of our graduate civil engineers go directly into practical civil engineering jobs, very few of which demand such advanced training. These are the men who will be responsible for the proper expenditure of billions of dollars for our future highways, bridges, sewage and water treatment plants and all the other myriad structures that civil engineers build. Will they make better use of such funds by having a knowledge of atomic physics—or by knowing the effects of the water-cement ratio on the strength of concrete and the value of geometric design in building safety into a highway?

It is evident that if civil engineering educators permit inroads on the established curricula, which have evolved through decades of experience to satisfy best the needs of actual engineering practice, they will produce graduates who will not so well satisfy those needs. Other training programs will inevitably spring up to fill the void and satisfy these needs even though the work prepared for can no longer be entitled "engineering work." Civil engineering graduates, if any, would then be limited to very specialized activities and the future civil engineers would hardly be recognizable in today's terms.

The question simply becomes one of deciding whether most of the positions now occupied by civil engineers are truly engineering jobs. If they are, experience would indicate that the present education in civil engineering, with normal evolutionary developments that recognize new techniques such as photogrammetry, electronic computation, plastic design in steel, and prestressing of concrete, is a proper education for most civil engineers. If not, we must completely change our concept of the place of civil engineering in the modern world with the result that most of us will no longer be considered engineers.

The practicing civil engineer must help civil engineering educators to combat the present trend in engineering education which is tending to belittle the historically recognized activities of civil engineers in general and which will, if not stopped, reduce most of the present civil engineers to the status of highly trained technicians and not professional engineers at all.

This assistance can take several forms. The ASCE representatives to the Engineers' Council for Professional Development must be constantly aware of the dangers involved in the present trends toward applying rigid standards broadly to all curricula in the accreditation procedure. The ASCE Committee on Engineering Education must continue its efforts in this direction and must make every effort to get practicing civil engineers appointed to accreditation committees. Practicing civil engineers must be willing to serve on accreditation committees when asked to do so in order to prevent non-civils from controlling civil engineering curricula.

The individual civil engineer can express his opinion to the officers of ASCE, who in turn can act through ECPD, and he should take the time to do so by letter and verbally at Society meetings.

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# Simple hammer-seismic

A new approach to shallow subsurface exploration for engineering purposes is now provided by equipment and procedure developed and tested during the past few years. The fundamental seismic refraction principle is utilized with modifications in customary instrumentation and technique. These modifications were first proposed by D. I. Gough, of the University of Witwatersrand, Union of South Africa. Additional development and testing have been carried out at the University of Wisconsin since 1956. The new method was used last year by the Mid-State Engineering Company for location studies on twelve miles of interstate highway in central Wisconsin.

In the new method the usual single subsurface dynamite blast and multiple geophones are replaced by successive hammer blows on the earth's surface at varying distances from a single stationary geophone. Another modification is in the method of depicting wave travel time. The customary photographic method requires that film developing equipment be available in the field if quick information is to be obtained. In contrast, the modified instrument has a cathode-ray tube which presents an immediate picture of the disturbance created at the geophone by the earth wave produced by any particular hammer blow. An electronic unit, in conjunction with the cathode-ray tube, measures the time interval during which the wave travels through the earth between the hammer and the geophone. All the electronic devices are powered by a 12-volt battery.

Interpretation of results is facilitated by constructing the familiar time-distance graphs employed to determine the depth to discrete layers of material. If a layer has a distinctive density it

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University of Wisconsin, Madison, Wis.

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Associate, Mid-State Engineering Company

Baraboo, Wis.

**Hammer-seismic apparatus can be transported and operated by a two-man crew. Tape running from geophone, in left foreground, measures distance to spot where hammer hits the earth's surface. Hammer impact closes micro-switch and starts the timing interval. A 12-volt battery powers the electronic "suitcase" on the table, which measures the time interval for the earth wave to travel from hammer to geophone.**

# apparatus for subsurface exploration

will transmit the wave at a different velocity from other layers. This makes depth computations possible and gives a clue as to the material in a layer.

The chief advantages of the new approach, as compared to borings or conventional seismic determinations, are the immediate availability of the information on the spot, the easy portability of the equipment, and the low operating and investment costs. The detailed information provided by borings cannot be obtained but, in certain circumstances, the inherent averaging characteristic of this method applied over a sizeable area may prove more informative than many borings each of which would be severely restricted in its sampling area. In some cases this technique, like the conventional seismic technique, can probe where borings cannot penetrate at a reasonable cost, as where boulders are numerous.

Correctly used, seismics can provide information that will serve as a basis for deciding whether any borings are necessary in a given area. If borings are required, seismic data will probably reduce the number of random holes required and will indicate questionable spots where borings should be concentrated. The use of a hammer instead of dynamite, as in the conventional seismic method, permits depth determinations in locations where dynamite would be a nuisance or prohibited entirely.

Site conditions impose certain limitations on the operation of the equipment. Excessive earth vibrations caused by a passing train, for example, may disrupt operations temporarily. Perplexing situations arise when the technique is used over frozen ground, over non-layered heterogeneous materials, or at partially flooded sites. Abrupt changes in the bedrock are bothersome but a uniformly sloping bedrock surface gives no difficulty. While such conditions are an inconvenience, they generally are surmountable.

The technique promises to be best suited for the determination of depth to bedrock on proposed highway and sewer projects although it can be used on almost any location problem. The characteristics of the equipment make it excellent for reconnaissance surveys because it provides information cheaply and quickly, and in such a way that it can be kept confidential. The technique is, however, subject to the vagaries of interpretation associated with geophysical investigations in general, and therefore cannot be used indiscriminately. For reliable results, the operator should be skilled, experienced and possessed of geologic knowledge of the area to be investigated.

# THE READERS WRITE

## Model studies throw light on culvert flow

To the Editor: William J. Bauer, M. ASCE, in his article, "Improved Culvert Performance Through Design and Research Studies" (March issue, vol. p. 167), pointed out places where improvements can be made in culvert design. But at least one of his suggestions is based on the erroneous idea that the culvert inlet must be submerged at least 1.5 velocity heads.

The outlet is a good place to recover velocity head if it is economically desirable to do so. However, the recovery flare must be submerged to function properly. As pointed out by Mr. Bauer, an adverse grade is required (this is an adverse hydraulic gradient and not necessarily an adverse culvert gradient) and it may not be possible to secure the adverse grade with an unsubmerged outlet. As an example, doubling the exit area recovers three-fourths of the velocity head less the expansion losses. The exit loss then becomes something greater than one-fourth the barrel velocity head instead of the full barrel velocity head.

The accompanying photos show the greater head at the inlet required to cause flow through a culvert of constant diameter as compared with one that has a flared outlet. The same rate of flow, barrel size and tailwater level were used in each case, the head difference at the inlet representing the difference in velocity head at the conduit exit minus the expansion loss that exceeds the friction loss for an equivalent length of uniform-diameter pipe.

Mr. Bauer states that the water-surface depth above the inlet should be 1.5 velocity heads. Presumably this is made up of an entrance loss of 0.5 velocity head plus 1.0 velocity head to force the water through the barrel. This is an obsolete assumption for certain inlets. For example, in the case of a typical hood inlet test ("Hydraulics of Closed Conduit Spillways, Part X, The Hood Inlet," St. Anthony Falls Hydraulic Laboratory Technical Paper No. 20, Series B, Minneapolis, Minn.), the submergence of the inlet was only 0.07 velocity head, yet the model culvert flowed completely full with a velocity head of 1.21 ft, which corresponds to a model velocity of 8.80 fps. Furthermore, the barrel was on a steep slope and its outlet was not submerged. This very low inlet submergence in terms of the velocity head is an indication that the source of the head necessary to create velocity in the barrel can come from downstream of the inlet as well as from upstream of the inlet as is ordinarily assumed.

The fact that a culvert can be made to flow full without depressing the invert or submerging the outlet would eliminate the deposition difficulties mentioned by Mr. Bauer. It would be necessary to submerge the outlet if a flare were used to recover exit velocity head, but the inlet submergence would not have to be increased.

I am in full agreement with Mr. Bauer that one of the "key problems to be overcome . . . [is the] education of designers in the application of well-known hydraulic principles. . . ." I have been doing research on culverts for 19 years and in all that time have learned no new principles beyond those taught in elementary hydraulics courses. But I have had my eyes opened and my thinking revised many times regarding the proper application of the hydraulic fundamentals.

A very effective tool in helping to explain the hydraulics of culverts and other structures is the demonstration channel designed expressly for educational use, which was used to make the accompanying photographs. Such demonstrations serve to get points across in a minimum of time, and no amount of explanation can take their place.

Fred W. Blaisdell, F. ASCE
*Project Supervisor*
*U. S. Dept. of Agriculture*
*Agricultural Research Service*
*St. Anthony Falls Hydraulic Lab.*
*Minneapolis, Minn.*

**Model culverts of uniform diameter with flared outlets show how flare recovers velocity head. Flow is the same in each culvert. Head gage is graduated in pipe diameters. Top: Head over inlet is high with outlet of constant diameter. Below: Three-fourths of velocity head is recovered with flared outlet.**

## Deflection calculations defended by author

To the Editor: In the May 1959 issue (vol. p. 343) J. J. Polivka, F. ASCE, comments on the fact that a calculated deflection of 0.2 in. which appears in my article in the March issue (vol. p. 175) does not agree with the value which was presented by Mr. Heinz in the November 1958 issue (vol. p. 853) and confirmed by Mr. Zutraun in the February 1959 issue (vol. p. 104).

The last sentence of my article clearly states that 0.2 in. is the horizontal deflection that is produced at Point 2 by flexure in the first 20 ft of the left-hand column. This calculation was made to illustrate the application of graphical integration. If this method had been applied to the whole frame, Mr. Heinz's result would have been confirmed.

Furthermore, it is not necessary to check the accuracy of graphical integration, also known as visual integration, because the acceptability of this method was established many years ago, as indicated by my references.

Charles W. Cunningham, F. ASCE
*Prof., Dept. of Civil Eng., The City College*
*New York, N. Y.*

## Bureaucratic evils on both sides of the fence

To THE EDITOR: Donald Walsh's article, "What Price Socialization of Engineering?" (in the April issue, vol. p. 246), although it makes some good points, displays in general a myopic outlook unfortunately characterictic of many engineers. In distorting the issue of professionalism into an economic one, Mr. Walsh draws a false dichotomy between the representatives of government and those of so-called "free enterprise." The bureaucratic evils he condemns in public agencies exist in but slightly modified form in the giant corporations. Both Big Business and Big Government, as well as Big Labor, are amply supplied with parasites. At the least, Mr. Walsh's blanket indictment of public agencies is no more justified than a blanket indictment of Big Business would be. The featherbedding artists, empire-builders, and make-work experts in government service have their parasitical counterparts in the middle-men profiteers, the executive gold-brickers, and the mind-molding admen of private enterprise.

Certainly the employed engineer has no cause for gratitude to the leaders of American industry. Any advantages in pay and working conditions in large private organizations usually are not because of management but in spite of it. With their mass-oriented personnel policies, their collusive agreements to hold down engineers' salaries, and their increasing use of "job-shops," industrial managers are doing their best to degrade engineering to the status of a trade and to reduce engineers to a docile flock of uninspired, mediocre technicians.

The threat to the private practice and professional status of engineering lies chiefly in the mass administration of engineering work either by bureaucrats or by executives unconcerned with maintaining professional standards. The problem cannot be solved, even partially, if prominent engineers persist in casting it in the spurious light of economic conflict, attempting to frighten us with the horrors of socialism.

C. W. GRIFFIN, M. ASCE

*Erlton, N. J.*

## Bias found in article on asphalt

To THE EDITOR: Your May issue gave an interesting and useful coverage of jet airport construction—with one exception. The purely promotional article by Arvin S. Wellborn, entitled "Asphalt Pavement Proved for Jets by Columbus AFB Test" (vol. p. 339), is not up to your usual standard of objective reporting.

In describing the conditions of the Columbus test, the author refers to "20,000 passes" of the test vehicle. It should be pointed out that this number of passes constituted only 5,000 coverages of the asphalt test section since it required four passes to provide uniform coverage for the full width of the test lane.

In a preamble to quotations from his own statement before the Congressional Subcommittee, Mr. Wellborn states that he discussed "the almost imperceptible differential settlement in the test pavement. . . ."

In the interest of accuracy, reference is made to the conclusions and recommendations of the Corps of Engineers, also published in the May issue (vol. p. 367): "An average 1¼-in. subsidence of the flexible pavement in the traffic lane, combined with a peculiarity of the test traffic pattern, resulted in excessive differential settlement between the trafficked area and the non-trafficked area to either side." It should be pointed out that "almost imperceptible" and "excessive" are hardly equivalent as descriptive terms.

The article can only be considered as promotional since it elaborates on those portions of the Corps of Engineers' report considered favorable to asphalt and minimizes or ignores the several conclusions that are unfavorable. It is perhaps significant that you also published in the May issue the full text of the Corps of Engineers' conclusions and recommendations (vol. p. 367). It is recommended reading for all those interested in paving.

GORDON K. RAY, F. ASCE
*Manager, Highways & Municipal Bur., Portland Cement Association*

*Chicago, Ill.*

## Nomograph for time of flow

To THE EDITOR: The Engineers Notebook section of the March issue contained a nomograph (vol. p. 174) prepared by W. S. Kerby, A.M. ASCE, for estimating the time of concentration for overland flow, using data contained in the ASCE *Transactions* paper, "Design of Drainage Facilities," by Gail A. Hathaway, Past President ASCE (vol. 110, pp 697-730, 1945).

A different form of this nomograph first appeared in the first edition of the *Data Book for Civil Engineers*, vol. 1, "Design" (Wiley, 1945) by Elwyn E. Seelye, F. ASCE. This nomograph was prepared by me at that time at Mr. Seelye's request in order to simplify the method of determining time of concentration. Almost all other methods used before that time were of the "by guess and by gosh" type. The source and results used for obtaining this nomograph are exactly the same as those used by Mr. Kerby.

It should be borne in mind that the basic method of computing runoff as covered in Mr. Hathaway's very able paper and that suggested by using the time of concentration are dissimilar. The time of concentration is used in the so-called "Rational Method" while Mr. Hathaway's method uses the principle of mass hydrographs.

There is, however, no reason why pertinent data from one method cannot be used in the other formula. For this reason it is felt that the data contained in the nomograph are satisfactory for determining the time of concentration.

JACK L. STAUNTON, F. ASCE
*Consulting Engineer*

*New York, N. Y.*

## Less glamorous types of engineering are still important

To THE EDITOR: Dr. Lee A. DuBridge's fine address, presented at the ASCE Los Angeles Convention and printed in the April issue (p. 45), gives an excellent picture of the opportunities in civil engineering research. His three points in regard to the seeking of research funds should be carefully read by all those interested in such activities.

In his concluding paragraph, however, he speaks rather disparagingly of road building, a significant portion of civil engineering. Yet, in the first part of his presentation, he paints an all-too-true picture of the difficulties of keeping road quality up to traffic requirements. He shows that increasing speeds, increasing truck weights, and increasing traffic counts keep the civil engineer busy in his attempt to answer the cries of the public. And these are not insignificant challenges.

The young men who are flocking into glamorous aeronautical, chemical and electrical engineering attest to the challenges in these fields. Engineering that is less spectacular, but nevertheless challenging, is not attracting students to the same degree. However, much of that type of engineering will still be needed in the future to relate the new developments to the needs of humanity in its day-to-day activities. The engineers who will furnish the solid core for such activities will be the civil engineers, by and large. The man on the street will still need the civil engineer to satisfy many of his technological needs.

One other point might be made and that is, what is the engineer's responsibility in society? Can he rush headlong into the challenges of space technology and atomic energy and disregard the more modest, mundane problems of the world? Is he not in danger of being considered irresponsible? The present trend in engineering enrollment seems to indicate an immaturity typical of a young, brash culture. It is a lot of fun to do the glamorous things, and often very difficult to discipline oneself to do the less showy ones. It requires a maturity which comes with age and which recognizes the need and place for all types of engineering. And in this picture, civil engineering will play a significant and vital role.

SUMNER B. IRISH, M. ASCE
*Assoc. Prof., Dept. of Civil Eng., Princeton Univ.*

*Princeton, N. J.*

# Weather Modification Conference

**A joint activity of American Society of Civil Engineers, American Meteorological Society, and Colorado Section, ASCE**

**Albany Hotel, Denver, Colo.** **August 27-29, 1959**

"This first joint conference on weather modification, sponsored by the Irrigation and Drainage Division of the American Society of Civil Engineers and the American Meteorological Society, has been planned to exchange the latest up-to-date information in this most important subject area. The program includes papers by top-flight experts on research activities, scientific field testing, practical procedures, evolution of results, and future outlook in connection with weather modification.

"A cordial invitation to attend this conference is extended to all those who are concerned with and interested in the various phases of weather modification. It is an opportunity to take part in a comprehensive conference on the subject."

DEAN H. T. PERSON
*Chairman, Irrigation and Drainage Division*

## REGISTRATION

**Albany Hotel**

Thursday, Aug. 27, 8:00 a.m. to 5:00 p.m.
Friday, Aug. 28, 8:00 a.m. to 12:00 noon
Registration fee: $3.00 per person (women and students, no charge).

## THURSDAY MORNING, AUG. 27

**9:00 a.m.**

***Session on Physical Basis of Weather Modification and Scientific Field Testing***

***Presiding: H. T. Person, Chairman, Irrigation and Drainage Division, ASCE, Dean, College of Engineering, Univ. of Wyoming.***

**Introduction: Robert D. Elliot, AMS, and N. A. Christensen, ASCE, Co-Chairmen**

**From Laboratory to Weather Modification**

VINCENT J. SCHAEFER, Schenectady, N. Y.

**Experiments on Treatment of Summer Cumulus Clouds in Arizona**

LOUIS J. BATTAN and A. R. KASSENDER, Inst. of Atmospheric Physics, Univ. of Arizona, Tucson.

**Effect of Meteoric Dust on Precipitation**

CHARLES S. SQUIRES, Commonwealth Scientific and Industrial Research Organization, Sidney, Australia.

**Physical Studies of Santa Barbara Storms**

THEODORE B. SMITH, Director of Research, Meteorology Research, Inc., Pasadena, Calif.

## THURSDAY AFTERNOON, AUG. 27

**2:00 p.m.**

***Session on Dispersal Systems and Practical Procedures***

***Presiding: Reuben G. Gustavson, President and Executive Director, Resources for the Future, Inc., Washington, D. C.***

**Seeding of West Coast Winter Storms**

ROBERT D. ELLIOTT, President, North American Weather Consultants, Goleta, Calif.

**Seeding Clouds in Tropical Climates**

WALLACE E. HOWELL, W. E. Howell Associates, Inc., Lexington, Mass.

**Generator Technology for Cloud Seeding**

DONALD M. FUQUAY, Northern Forest Fire Lab., U. S. Forest Service, Missoula, Mont.

**Seeding Results in the Santa Clara County Area**

ARNETT S. DENNIS, Vice President, Weather Modification Co., San Jose, Calif.

## FRIDAY MORNING, AUG. 28

**9:00 a.m.**

***Session on Evaluation***

**Presiding: Finley B. Laverty, Director, ASCE; Ass't Chief Engr., Los Angeles County Flood Control District**

**Final Report of the Advisory Committee on Weather Control**

FREDERICK A. BERRY, Rear Admiral, USN (Ret), Aerometric Research, Inc., Goleta, Calif.

**Physical Evaluation of Seeding Effects**

HORACE R. BYERS and ROSCOE R. BRAHAM, JR., Dept. of Meteorology, Univ. of Chicago.

**Evaluation of Seeding Trials**

ARNOLD COURT, Pacific Southwest Forest and Range Experiment Station, U. S. Forest Service, Berkeley, Calif.

## FRIDAY AFTERNOON, AUG. 28

**2:00 p.m.**

***Session on Outlook for the Future***

**Presiding: Horace R. Byers, Chairman, Dept. of Meteorology, Univ. of Chicago**

**A Weather Modification Program for the Future**

HOWARD T. ORVILLE, Former Chairman, President's Advisory Committee on Weather Control; Vice President, Beckman & Whitley, Inc., San Carlos, Calif.

**The Santa Barbara Project**

ROBIN R. REYNOLDS, Principal Hydraulic Engr., Dept. of Water Resources, Sacramento, Calif.

**Seedability of Large-Scale Storm Systems**

FERGUSON HALL, Office of Meteorological Research, U. S. Weather Bureau, Washington, D. C.

## SATURDAY AUG. 29

Field tour over Loveland Pass to the High-Altitude Observatory at Climax, Colo., with lunch en route.

## FEATURES FOR WIVES

Special luncheons, dinners and entertainment will be provided for the wives in connection with this conference.

## CONFERENCE COMMITTEE

**Co-Chairmen**

For AMS, Robert D. Elliott, President, North American Weather Consultants, Goleta, Calif.; for ASCE, N. A. Christensen, Director, School of Civil Engineering, Cornell Univ.

**Colorado Section Conf. Chairman**

Robert L. Mueller, Armco Drainage & Metal Products, Inc., Denver, Colo.

# SOCIETY NEWS

## Stand Up and Be Counted!

The title for this month's story on the campaign for funds for the United Engineering Center is cribbed from two Local Sections. First to make use of it as a rallying cry for contributions was the National Capital Section. More recently the Tennessee Valley Section has quoted it to good effect (in the "Tennessee Valley Engineer") in an effective plea to its six Branches.

With good reason the T.V. Section is proud of the University of Tennessee Student Chapter, whose contribution to the UEC fund represents 100 percent of the membership. Perhaps in this connection it should be noted that no student or Student Chapter has been approached for donations. Their gifts are entirely voluntary, and demonstrate their attachment to the Society and their awareness of the importance of the Center to the profession.

Three more Local Sections—West Virginia, Central Ohio, and Tri-City—have now won places on the UEC Honor Roll. This brings to eighteen the number of Sections that have reached or exceeded their quotas—about 25 percent of the Society's 78 Sections. District 4 is still the only District that has exceeded its quota. District 9, with 91 percent of its allotment pledged, will probably be the next to go over the top.

The Philadelphia Section has voluntarily increased its gift to the UEC fund from $300 to $2,400. Thanks are also due the University of Utah Student Chapter, which has just sent $25, its initial contribution to the fund. To date fifteen friends of the late Charles E. Trout, for many years Treasurer of the Society, have contributed $529.50 to the building fund in his name.

The overall picture in the drive for funds is good, with 86 percent of the allotted $8,000,000 total pledged. Over $3,000,000 of the $6,803,497 pledged by industry and the several professional societies has been raised in the New York metropolitan area. ASCE, with 65 percent of its goal attained, is trailing the chemical, electrical, and mechanical engineers. The average contribution per ASCE subscriber is $60, but only 8,541—barely a fifth—of our members have contributed. With groundbreaking set for early fall, now is the time for all to make a contribution, or an additional contribution as some have done. And it also is a time to encourage others to contribute.

In the overall member gifts campaign, there have so far been 52,305 contributors, roughly one-fifth of the 250,000 members of the major societies represented. So for every engineer who has contributed to the Center to date, there are four who have not.

At the kickoff dinner inaugurating the UEC fund campaign over a year and a half ago, President Herbert Hoover, Hon. M. ASCE, called the Center "a proper and stimulating home for the engineers of America." Donald A. Quarles, Deputy Secretary of Defense, put it even more strongly when he stated that "the Pentagon views the Center as important to the welfare of our country."

### Table 1. Quotas and Pledges to UEC as of June 12

| Society | Goals in Dollars | No. of Subscribers | Amount Pledged | % of Goal | $ per Subscriber |
|---|---|---|---|---|---|
| ASCE | 800,000 | 8,541 | $516,957 | 65 | 60 |
| AIME | 500,000 | 4,187 | 285,061 | 57 | 68 |
| ASME | 800,000 | 10,744 | 530,367 | 66 | 49 |
| AIEE | 900,000 | 20,240 | 757,576 | 84 | 37 |
| AIChE | 300,000 | 7,202 | 298,605 | 99 | 41 |
| Others | . . . . | 1,391 | 70,461 | .. | 51 |
| Total | *3,000,000 | 52,305 | $2,459,028 | 82 | 47 |
| Industry | 5,000,000 | 431 | 4,344,469 | 87 | 10,000 |
| Grand Total | 8,000,000 | 52,736 | 6,803,497 | 86 | |

*While the overall goal of member giving is shown as $3,000,000, the quotas accepted by the Societies total $3,300,000.

**Historic moment—representatives of the United Engineering Trustees and the Turner Construction Company meet at the Engineers Club to sign a contract for the new United Engineering Center. Seated, left to right, are Willis F. Thompson, chairman, Real Estate Committee of UET; Andrew Fletcher, president of UET; and E. K. Abberley, vice-president of the Turner Construction Company. Standing are Harold C. Bernhard, partner in Shreve, Lamb & Harmon Associates, architects for the center, and W. B. Ball, vice-president and secretary of the Turner Company. Groundbreaking for the eighteen-story steel-frame building, with metal, glass, and limestone exterior, is now set for mid-October.**

## ASCE Giving Passes $516,213 as of June 5

| Local Section | Quota | Amount Pledged | % Quota |
|---|---|---|---|
| **ZONE I (1318)** | **$197,300** | **$141,800** | **72** |
| **District 1 (648)** | **133,300** | **95,911** | **72** |
| Brasil (4) | 2,100 | 190 | 9 |
| Metropolitan (567) | 119,200 | 90,584 | 76 |
| Panama (7) | 1,300 | 215 | 17 |
| Puerto Rico (27) | 3,100 | 2,800 | 90 |
| Rep. Colombia (6) | 2,400 | 230 | 10 |
| Venezuelan (37) | 5,200 | 1,892 | 36 |
| **District 2 (392)** | **43,400** | **28,356** | **65** |
| Connecticut (116) | 11,000 | 8,780 | 80 |
| Maine (66) | 4,700 | 3,586 | 76 |
| Massachusetts (160) | 23,000 | 12,804 | 56 |
| New Hampshire (16) | 1,800 | 558 | 31 |
| Rhode Island (33) | 2,900 | 2,598 | 90 |
| **District 3 (278)** | **20,600** | **15,033** | **73** |
| Buffalo (51) | 4,400 | 2,740 | 62 |
| Ithaca (47) | 2,400 | 2,734 | 114 |
| Mohawk-Hudson (66) | 7,500 | 3,598 | 48 |
| Rochester (42) | 1,900 | 2,334 | 123 |
| Syracuse (51) | 4,400 | 2,842 | 65 |
| **ZONE II (2,087)** | **169,700** | **105,582** | **62** |
| **District 4 (596)** | **34,000** | **40,314** | **119** |
| *Delaware (109) | 4,100 | 4,019 | 98 |
| Lehigh Valley (89) | 4,200 | 5,517 | 131 |
| Philadelphia (227) | 20,000 | 24,993 | 125 |
| Central Pa. (171) | 5,700 | 5,785 | 101 |
| **District 5 (325)** | **27,000** | **8,674** | **32** |
| Nat'l Capital (325) | 27,000 | 8,674 | 32 |
| **District 6 (543)** | **49,000** | **26,901** | **55** |
| Maryland (208) | 15,000 | 7,355 | 49 |
| Pittsburgh (209) | 17,000 | 10,708 | 63 |
| Virginia (107) | 13,300 | 4,932 | 37 |
| West Virginia (19) | 3,700 | 3,906 | 106 |
| **District 10 (623)** | **59,700** | **27,193** | **46** |
| Alabama (65) | 8,900 | 2,704 | 30 |
| Florida (23) | 11,500 | 1,445 | 13 |
| Georgia (125) | 11,000 | 7,413 | 67 |
| Miami (13) | 5,200 | 785 | 15 |
| Nashville (58) | 2,700 | 2,775 | 103 |
| N. Carolina (35) | 6,300 | 3,151 | 50 |
| S. Carolina (92) | 4,900 | 2,540 | 52 |
| Tenn. Valley (212) | 9,200 | 6,380 | 69 |
| **ZONE III (2,453)** | **202,200** | **131,764** | **65** |
| **District 7 (394)** | **39,900** | **16,992** | **43** |
| Duluth (1) | 1,500 | 10 | 1 |
| Michigan (60) | 18,000 | 3,425 | 19 |
| Northwestern (62) | 8,000 | 2,770 | 35 |
| Wisconsin (258) | 10,700 | 10,241 | 96 |
| S. Dakota (11) | 1,700 | 446 | 26 |
| **District 8 (356)** | **$37,100** | **27,413** | **74** |
| Cent. Illinois (88) | 6,500 | 4,165 | 64 |
| Illinois (221) | 29,000 | 21,949 | 76 |
| †Tri-City (47) | 1,600 | 1,299 | 81 |
| **District 9 (782)** | **45,700** | **41,435** | **91** |
| Akron (39) | 3,100 | 1,545 | 50 |
| Central Ohio (154) | 5,100 | 5,098 | 100 |
| Cincinnati (126) | 4,700 | 6,607 | 141 |
| Cleveland (31) | 9,300 | 3,950 | 42 |
| Dayton (24) | 3,300 | 2,036 | 62 |
| Indiana (270) | 11,000 | 14,069 | 128 |
| Kentucky (105) | 6,100 | 6,640 | 109 |
| Toledo (33) | 3,100 | 1,490 | 48 |
| **District 14 (229)** | **31,500** | **14,765** | **47** |
| Mid-Missouri (49) | 3,500 | 1,383 | 40 |
| Mid-South (65) | 11,000 | 5,614 | 51 |
| Oklahoma (48) | 6,900 | 2,679 | 39 |
| St. Louis (67) | 10,100 | 5,089 | 50 |
| **District 16 (692)** | **48,000** | **28,659** | **60** |
| Colorado (41) | 13,900 | 2,454 | 18 |
| Iowa (114) | 5,900 | 5,058 | 86 |
| Kansas City (317) | 12,000 | 12,952 | 108 |
| Kansas (116) | 7,600 | 3,950 | 52 |
| Nebraska (89) | 6,300 | 3,805 | 60 |
| Wyoming (15) | 2,300 | 440 | 19 |
| **ZONE IV (2,411)** | **230,800** | **137,067** | **59** |
| **District 11 (1402)** | **132,600** | **77,637** | **59** |
| Arizona (149) | 5,000 | 5,409 | 108 |
| Hawaii (213) | 6,300 | 7,506 | 119 |
| Intermountain (46) | 4,700 | 2,069 | 44 |
| Los Angeles (427) | 50,200 | 21,124 | 42 |
| Sacramento (157) | 16,300 | 7,809 | 48 |
| San Diego (63) | 6,000 | 2,586 | 43 |
| San Francisco (347) | 44,100 | 31,134 | 71 |
| **District 12 (493)** | **40,400** | **24,741** | **61** |
| Alaska (14) | 2,200 | 790 | 36 |
| Columbia (74) | 2,200 | 2,803 | 127 |
| Montana (19) | 3,300 | 1,300 | 39 |
| Oregon (84) | 10,900 | 4,103 | 38 |
| Seattle (122) | 12,200 | 6,643 | 54 |
| S. Idaho (45) | 2,300 | 3,278 | 143 |
| Spokane (49) | 3,100 | 2,033 | 66 |
| Tacoma (79) | 4,200 | 3,476 | 83 |
| **District 15 (516)** | **57,800** | **32,189** | **56** |
| Louisiana (59) | 13,000 | 2,904 | 22 |
| Mexico (1) | 1,400 | 40 | 3 |
| New Mexico (26) | 4,000 | 1,505 | 38 |
| Texas (430) | 39,400 | 27,740 | 70 |
| Totals (8,269) | $800,000 | $516,213 | 65 |

Note: Number of pledges shown in parentheses.
*Quota exceeded since April 24.
†Quota exceeded as of June 15.

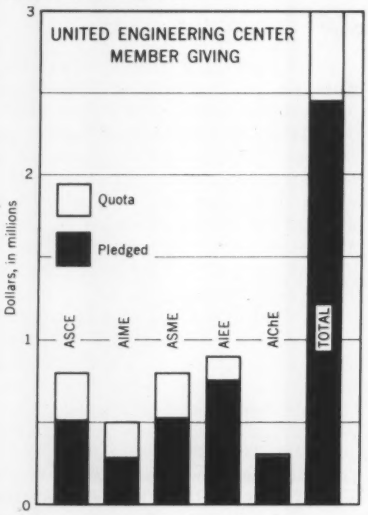
Fig. 1. Member giving for United Engineering Center as of June 12.

## UEC HONOR ROLL

There are eighteen names on the Honor Roll now. New additions to the fast-growing list are the West Virginia, Central Ohio, and Tri-City Sections. The Sections are listed in the order of meeting their goals, and the figures indicate percentages attained on June 5.

**Kentucky (109)**
**Lehigh Valley (131)**
**Nashville (103)**
**Cincinnati (141)**
**Columbia (127)**
**Philadelphia (125)**
**Hawaii (119)**
**Rochester (123)**
**Ithaca (114)**
**Southern Idaho (143)**
**Indiana (128)**
**Delaware (100)**
**Kansas City (108)**
**Central Pennsylvania (101)**
**Arizona (108)**
**West Virginia (106)**
**Central Ohio (100)**
**Tri-City (100)**

Congratulations also to **District 4**, which continues to be the only District that has exceeded its quota.



**At a recent joint meeting of the Knoxville Branch of the Tennessee Valley Section and the University of Tennessee Student Chapter, Hendon Johnston, president of the Tennessee Valley Section, and Albert S. Fry, chairman of the Section's UEC fund drive, received the Chapter's donation to the UEC fund. Pictured here, in usual order, are Ed Bodkin and Allen Anthony, vice-president and president of the Student Chapter; Prof. J. T. Price, Faculty Adviser; and Messrs. Fry and Johnston.**

# Jet Age Airports Studied at Houston Conference

Drawing on experience gained in operating the new jets, engineers are evolving new concepts for the design and operation of jet-age airports. To provide the stimulus and opportunity for the free exchange of such information, the Air Transport Division conducted its second Jet-Age Airport Conference at Houston, May 20-22. In orienting the conference delegates, the Division chairman, John M. Kyle, Jr., explained that the purpose of the conference could be demonstrated quite clearly by noticing the variety of industries that were represented. In attendance were representatives of the aircraft manufacturers, airline operators, airport operators, federal agencies, equipment manufacturers and suppliers, planners and designers. All came to pick up new ideas, and to pass along, for the common good, any ideas that they had picked up in their own experience.

## A Look Into the Future

Experience has shown that the design and operation characteristics of aircraft have raced ahead of the airport facilities and operating procedures. Thus, everyone present strained hard to look as far into the future as possible in establishing criteria for today's design.

Typical of this look into the future was the presentation of J. W. Pocock, of Booz-Allen Applied Research, Inc., Chicago, who spoke on "The Pattern of Future Air Travel Demands." As Mr. Pocock phrased the situation, air transport is "no longer the race-horse, but now the work-horse." He charted the emergence of "general" aviation to surpass the earlier concept of "air-carrier" traffic. It was his estimate that, by 1970, the industry will have to provide for sixteen billion passenger miles, with attention to the complete package from ticketing, feeders, ground transportation, terminal operation, flight service, etc. He thinks that the demand by 1970 will be four to five times the present design factors, which could be satisfied only if the equivalent of one new airport were provided each day to meet the growth demand.

Mr. Pocock differentiated between "general" airports which would serve private and cargo aircraft and "major" airports in the 290 traffic generating centers of the United States. He indicated there was no need for increase in the 700 "major" airports, but that vast improvement in facilities would be required. Mr. Pocock went on record with his guess that the fixed wing aircraft would establish the airport criteria for any foreseeable future.

An entirely different viewpoint was expressed by Dr. Charles S. Draper, head of the Department of Aeronautics and Astronautics at M.I.T., who spoke on the "aircraft of the future." Dr. Draper described the guided missile approach to controlled flight which would no longer be dependent upon the weather, traffic control, human frailties, and similar present limitations on air transport. He indicated that, even at the present time, exotic fuel take-offs are entirely feasible.

This position was supported, to a certain extent, by the report of the ASCE Committee on VTOL-STOL Aircraft, as presented by William C. Borland, chairman of the Committee and coordinator of engineering for the Port of New York Authority. The data which this Committee has waded through indicate that it is only a matter of time before vertical or short-run takeoff aircraft will be in operation.

It is interesting to note that much of this background information was considered in setting up the design criteria for the new Washington International Airport. Richard Huber, project director for this giant project, stopped the show with his presentation. An entirely new concept of unit service areas for jet aircraft, and the use of mobile lounges to transport passengers from ticketing gates to such service centers started a spirited discussion.

## Airport Environment to Make Greater Demands

That vast areas in and adjacent to urban centers have been affected by airports was brought into focus by several speakers on the conference program. The extensive areas, affected by a jet airport, have caused most of the new locations to be selected at areas as remote as possible from metropolitan centers, and yet somewhat accessible for ground transportation. This in itself obviously creates a lot of problems. S. Richard Rio, of the Air Base Planning Division of the U. S. Air Force, described the impact of future airports and air bases on surrounding flora and fauna.

Another paper by Phillip E. Geissal, chief planning engineer of Kansas City, demonstrated that "the airport as a unit must be fitted into the urban pattern to best perform its full internal function." Mr. Geissal indicated that strict zoning would be required to describe the use of areas affected by jet age airports, with good prospects that industrial or commercial districts could develop in the vast open areas adjacent to the airports.

A panel on ground transport was arranged by Prof. Vincent J. Roggeveen, of M.I.T., and included among the participants Robert F. Wall, of United Airlines, Ben E. Nunn, of Parking Associates Group in Pasadena, and William J. Cutbirth, Jr., of the Airline Ground Transportation Association, in Los Angeles. This panel and the resulting discussion, covered everything from current bus and limousine operation to high-capacity, high-speed transit and helicopter service.

## Financing New Airport Facilities

By the time those at the conference had estimated the probable need for new airport facilities, they began to translate such demands into dollars and found need for some expert advice on financing. For this they looked to Walter Cleave, vice-president of Blyth and Company, Chicago, to explain the processes of airport revenue bond financing. There are so many angles to this, that the general conclusion was that no general conclusion could be reached about where to get the money for future airports. Mr. Cleave did point in several directions, each of which would have to be studied by the planners of any major airport project.

Quite a difference of opinion developed among those in attendance about the participation of airlines and airport operators in the matter of financing and operating airport facilities. Dan C. Meenan, vice-president of United Airlines, indicated that an independent agency should undertake a study of the economic interrelation of airports and airlines, and expressed his own viewpoint that every airport operating board or authority should have representation from the user airlines.

## Experience Related

Much of the conference was devoted to a careful study of the experience obtained in operating jets. James P. O'Donnell, consulting engineer of New York City, who termed himself a spokesman for the gas station operators, gave data on the operation of jet fueling systems, and some indication of the problems to be encountered in handling solid fuels which are now considered a prospect for aircraft of the near future. It was his prediction that liquid fuels would meet airport needs for some time to come.

Much of the discussion in relationship to the desire for new airports deals with runway lengths necessary for operation of jet planes. A very scholarly paper describing the criteria to be used in design of runway lengths was presented by Prof. Robert J. Horonjeff, of the University of California, based on a study made for United Airlines, with Richard E. Coykendall participating for United.

## Airport Operation More Complex

Despite the fact that these experts of the air transport industry were gathered

to find ways of improving and minimizing airport operating problems, it appeared that the increased traffic and new-type aircraft are continuously increasing the number of problems to be solved. This led E. Thomas Burnard, executive vice president of the Airport Operators Council, to report a general conclusion of the Operators that new aircraft must be designed to fit into the circumstances offered by major airports already built and being built, instead of catering to a continuous demand for new, larger and different facilities. As Mr. Burnard pointed out, "a single stroke of the pen in Washington can destroy the orderly plans of airport men."

This contention was borne out by the chief engineer of Orly Airport, in Paris, M. Henri Vicariot who, in describing the unusual facilities of their new field and terminal, pointed out that it was designed to serve present concepts of aircraft.

### Airport Pavements Studied

New weights, new fuels, and blast effects have given engineers some new work, as detailed during a panel conference arranged by Willard J. Turnbull, chief of the Soils Division, U. S. Corps of Engineers, Vicksburg. This group has done much of the testing on pavement behavior.

That the behavior of pavements is subject to some new indignities was pointed out by Henry Lichtefeld, deputy chief, of the Airport Engineering Branch of the Federal Aviation Agency, who described jet fuel spillage and blast effects.

Throughout the conference there was reference to the pressing need for regularity in the operation of the jets, or all-weather operations of airports. As one of the discussers put it, "the best airport in the world cannot serve a pilot who cannot land his aircraft on that field". While much of the new approach control equipment is electronic, there is still need for more effective visual guidance equipment. Various types of high intensity approach lights have been installed and tested, with various results as reported by Robert F. Gates, of the National Aviation Facilities Center, Atlantic City; Col. Harry Howton, of the U.S. Air Force; and John Veerling, of the Port of New York Authority.

The Texas Section's Houston Branch assumed responsibility for all local arrangements for the conference. Robert M. Collie, president of the Houston Branch, had set up a committee consisting of Herbert M. Shilstone, general arrangements chairman; Mason G. Lockwood, honorary chairman; and numerous other members of the Branch. Coordinating the conference was the responsibility of Reginald J. Sutherland, general chairman, with program arrangements by Prof. John Hugh Jones, University of California.

## NSF Grants Available for Course Improvement Studies

There is growing concern for modernization of education in science and engineering. Industry and government agree on the need for general upgrading of standards. But it is up to the educators to carry the ball.

The ASCE Committee on Engineering Education is fully aware of the problem and is actively engaged in finding a solution. The Committee recognizes two crucial needs: (1) Improvement in the quality of education in the basic disciplines such as math and science; (2) reappraisal of curricula in advanced categories such as the engineering sciences and specific specialties of engineering. Course improvement is considered essential if engineering education is to keep pace with technological growth.

The National Science Foundation offers a positive approach to the problem in its "Programs for Education in the Sciences." The Committee on Engineering Education calls particular attention to the availability of NSF funds for financing: (1) Summer Institute Programs; (2) Summer Conference Programs; and (3) Programs of Curricula Study and Improvement.

Representatives of educational institutions, professional scientific societies, and other organizations may apply for NSF grants. Teachers and students of science, mathematics and engineering may participate in the Programs. NSF pays the costs of organization and staffing. In addition, it pays transportation costs and living expenses of registrants.

Summer Institute Programs, of four to ten weeks' duration, are intended to improve the capacities and abilities of instructors of math and science especially at the high school and junior college levels.

Summer Conference Programs are similar to Summer Institutes, but shorter in duration. Anything under four weeks is called a Conference, and over four weeks an Institute. Engineering professors would find difficulty in attending an Institute, but would be able to break away long enough for a Conference.

Programs of Curricula Study and Improvement may embrace meetings or seminars of department heads and practicing engineers. These meetings provide for the study of curriculum content and methods for improving instruction in specific fields such as structural engineering, soil mechanics, sanitary engineering or fluid mechanics. Such meetings might last for a week or longer, or just a few days.

Proposals for 1960 Summer Institutes must be submitted to NSF by August 1, 1959. Proposals for 1960 Summer Conferences must be in by December 15, 1959. Address all inquiries regarding these proposals to:

The Institutes Section
Division of Scientific Personnel and Education
National Science Foundation
Washington 25, D. C.

No deadline is set for submitting proposals for Curricula Study and Improvement programs. Address all inquiries to:

The Course Content Improvement Section
Division of Scientific Personnel and Education
National Science Foundation
Washington 25, D. C.

A general information pamphlet is available by writing to ASCE headquarters.

## New Competition for Mead Prizes Opens

"Under What Conditions May an Employee Do Engineering Work Outside His Normal Employment?" is the subject selected by the Board of Direction for the 1960 Daniel W. Mead Prize Competition. Both Associate Members and students will write on the same topic this year.

It should be noted that because of the change in membership grades, the former Junior Member Award is now known as the Associate Member Award. However, it will continue to be a younger member award, and to preserve it as such the rules of award have now been changed to read as follows: "The Associate Member Award is open only to Associate Members of the Society in good standing, who have not passed their 32nd birthday at the time their papers are presented."

To be eligible, papers must not exceed 2,000 words, and they must be presented before a Local Section or Student Chapter meeting. Only the one best paper from each Section and Chapter can be entered in the final competition. All entries must reach the office of the Exective Secretary at Society Headquarters by May 1, 1960.

The Associate Member Award consists of a cash prize of $100 and an engraved certificate, while the student prize carries a cash prize of $50 and an engraved certificate.

## *Remodeling of U.S. Capitol May Be Viewed by ASCE Convention Visitors*

**Members are reminded that the scene for this year's Annual Convention shifts to Washington, D.C.—Hotel Statler, October 19-23. One of the interesting construction sights available to engineers attending the Convention will be the remodeling of the U. S. Capitol, shown here in before (left) and after views. The $10,000,000 project will result in three-way improvement of the historic structure. The existing east wall of the central part of the building is sandstone, which is rapidly deteriorating. This wall will remain undisturbed and will be reproduced in marble in an extended position 32½ ft eastward. The existing exterior wall will then become an interior wall, protected from the elements. In addition, the design error in the overhanging dome over the east portico will be corrected. Finally, the relocation of the east wall will result in the provision of much-needed additional space (78,500 sq ft) in the Capitol for Congress, its offices and employees. There will be a story about the Convention in the August issue, and the program in the September issue. Eugene F. Baldi is general chairman.**

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## Board Reaffirms 1948 Policy Statement On Engineers in Public Practice

*At its Cleveland meeting the Board of Direction voted to approve a recommendation of the Committee on Engineers in Public Practice that the Society continue to direct attention to action on the part of federal agencies in the expansion of their activities into the field of private practice, in so far as their activities are contrary to the ASCE policy adopted January 20, 1948. For the benefit of those wishing to refresh their memories, the 1948 Statement of Policy is reprinted here.*

The American Society of Civil Engineers has a membership of over 20,000 [now 42,925] employed in all phases of our political economy, including responsible positions in government—national, state, county and municipal—and including also those engaged in technical instruction and in the private practice of engineering. The Society recognizes that, because of the diversity of its professional activities, its national standing and the fact that it represents the great majority of Civil Engineers in the United States, it has a clear responsibility to perform in respect to the profession and the various public agencies.

1. The Society is particularly concerned with the administration of those agencies having engineering duties or related tasks to perform and believes that to the best of its ability, it should see to it that such administration is carried out in the best interests of both the public and the profession.

The Society therefore will cooperate to the fullest extent with the heads of all government agencies employing engineers to the end that its responsibilities may be met, but will take appropriate action whenever the interests of the public and the profession are adversely affected.

2. The Society recognizes that within certain governmental institutions, such as the technological departments of our universities, there are employed engineers of special technical skill, whose advice is sought by both private and governmental agencies. The Society believes that this specialized talent should be available only to those seeking it and that such services should not be offered or rendered except with the knowledge and consent of the institutional authority. The Society does not, however, approve of such engineers maintaining a private office and a staff either by themselves or with others in direct competition with engineers not in the public employ.

3. The Society recognizes that there are in some of the government bureaus administrative positions which carry a highly technical responsibility. The Society points out that these positions are frequently filled by men with no engineering training, and that such lack of technical qualification works to the disadvantage of the general public as well as the Bureau concerned, of the engineering employees of the Bureau, and lowers the prestige of the engineering profession. The Society recommends that such administrative positions, especially those that supervise large numbers of engineers, should be filled by men of suitable technical training. The Society will therefore use its best efforts to encourage this policy.

4. The Society recognizes that during peace times, the Army and Navy and Air Forces should be maintained and trained in the art of warfare; but it believes also that it is essential to maintain a strong group of engineers in private practice. The Society also recognizes that there are certain types of engineering projects, in which the public interests may be best served, by doing the work of engineering with the staffs of the responsible Bureaus. The Society is pleased to note that many of the government agencies have already adopted a policy of contracting with private engineers to furnish technical services. The Society desires to use its best efforts to maintain these relations.

5. The Society has observed that, frequently, certain governmental agencies have engaged in the promotion of, and negotiation for, engineering work on irrigation, drainage, land reclamation, power, water supply, airports, housing and other projects, to the end that the engineering staffs of the agencies may be continuously employed. The Society does not believe that the best interests of the public are served in many of these instances, especially in the medium and smaller-sized projects, and will use every effort to discourage similar practices in the future.

6. The Society recognizes that within certain governmental agencies, there are administrative problems that may relate largely to staff procedure, office locations, territorial responsibility, etc., and that may affect the economic status of its engineer employees. The Society believes that, so long as the individual engineer employee is accorded opportunities for professional advancement, and so long as the effectiveness of the engineering staff is not weakened by the proposed changes, the Society should take no cognizance of such administrative or organizational matters.

7. The Society recognizes that it is in the interest of the Government of the United States that the best technical information and the best qualified talent in the country be made available to other nations requesting services needed to solve their domestic engineering problems, and that this assistance may require the temporary assignment of properly qualified individual specialists, selected either from government service or private enterprise, as advisers to other governments together with such assistance as may be necessary for the accomplishment of their individual assignments. However, the Society does not believe that any federal agency should be permitted to prepare engineering designs, plans, and specifications for, or engage in supervision or construction of, projects for foreign governments unless the national interest demands otherwise. The Society will therefore exert every effort to obtain compliance with the above policy in connection with requests from foreign governments for technical services.

## The Role Of Local Sections In Professional Conduct Proceedings

For a Society with nearly 43,000 members, instances of disciplinary action for violations of the ASCE Code of Ethics are very infrequent. Yet there are always a few cases of alleged unprofessional conduct under consideration by the Board of Direction. Unpleasant as may be the condemnation of a fellow member, the Board is vigilant in efforts to maintain proper standards of professional conduct and does not hesitate to act when circumstances indicate the necessity.

Regulations governing disciplinary action are covered in Article III of the Constitution and Article II of the By-laws.

When knowledge indicating the likelihood of unprofessional conduct is received, the case is referred to the Committee on Professional Conduct for investigation. That committee, which is composed of six members of the Board of Direction, then makes a thorough investigation into the circumstances. Evidence is assembled from any available source. The member involved is invited to present a statement of his views regarding the alleged misconduct. The member may be given an opportunity to appear in person before the committee. All this is time-consuming, but the committee exerts every reasonable effort to accumulate as much pertinent evidence as possible.

The committee, in session, then reviews all the evidence before it and decides what disposition of the case it will recommend to the Board. If it concludes that there are not sufficient grounds to justify disciplinary action, it will recommend that the case be dropped. On the other hand, if some degree of discipline is deemed proper, appropriate recommendation will be made to the Board of Direction.

The case then is in the hands of the Board for final disposition. The member is advised of the charges against him, notified of the time and place of the meeting of the Board at which his case will be considered, and invited to present a defense either in person or in writing, as he may choose.

The Board weighs the evidence, including the report of the Committee on Professional Conduct and the presentation offered by the accused member, and renders its collective judgment as to appropriate action. The result may be expulsion of the guilty member in an instance of flagrant violation of the Code. If the case involves a lesser infraction, the penalty may be suspension for some stated period, or a letter of admonition may be deemed sufficient.

Criticism sometimes is offered to the effect, that speedier action should be taken with respect to professional conduct cases. Even though the Board fully realizes the desirability of speed, it is always reluctant to condemn a member without assurance that the investigation has been thorough and that the evidence warrants disciplinary action. It is a serious matter to place a black mark on the record of a member. It may happen that in a case where the original evidence seems to fully support allegation of misconduct, later developments will disclose extenuating circumstances, or inadvertence on the part of the member, such that only mild discipline is indicated or that the charges should be dismissed.

It is not a simple matter for the Committee on Professional Conduct to carry out its duties as outlined here. The Local Sections can be of great assistance in this connection. Some have been. All are urged to be diligent in discovering and reporting instances of unprofessional conduct. A Section can render valuable aid in gathering pertinent evidence for submission to the Committee on Professional Conduct. However, there are limits beyond which a Section should not carry such activities. Any Section, or any individual, has the right—and the obligation—to direct attention to circumstances that appear to involve unethical conduct.

Once a case has been brought to light, it is entirely appropriate for a Local Section to institute an on-the-ground investigation. Some vigorous Sections have done so. Such an investigation may bring together printed documents, correspondence, perhaps the record of an interview with the member concerned, or other pertinent evidence. All this is for submission to the Committee on Professional Conduct. In its report, the Section may even care to express an opinion as to the merits of the case for the benefit of the Committee and the Board.

Having proceeded that far, the Local Section has performed its best service. It should *never* undertake any official action either condemning or exonerating a member. That action is the prerogative solely of the Board of Direction. Some organizations operate differently but, in ASCE, disciplinary action against a member is taken only at the national level.

There is another kind of action where Local Sections can be of substantial help. One of the more frequent violations of the Code of Ethics is found in competitive bidding for engineering services on a price basis. Whenever information is received at the headquarters office that a client has requested bids for submission at a future date, the client is contacted by wire, phone, or mail with a request that the procedure be abandoned and that an engineer be selected by negotiation in accordance with the program recommended by ASCE. Such contact emphasizes the fallacy of engaging professional services on the basis of a low competitive-bid

price and states the rather obvious fact that "cheap" engineering provides an almost certain basis for costly end results. The client is told that bidding is not in the best public interest and that, for that reason, it is unethical for an engineer to compete on a price basis.

In many cases, these preventive efforts have brought the desired results. The client has appreciated the wisdom of the request, has recalled his invitation to bid, and has proceeded to select his engineer by negotiation. This is highly gratifying. It is far more satisfying and far more constructive to forestall bidding than to accept the unpleasant duty of disciplining members after the fact of unethical competition.

In situations of this sort, Local Sections can render valuable service. Obviously, the headquarters office cannot hope to learn when invitations to bid are issued in distant parts of the country unless someone takes sufficient interest to supply the information. Local Sections should be alert in this respect. Even further, Sections appropriately may make direct contact with clients in their own areas in the manner outlined above. It may well be that local contacts can bring results quicker than is possible by working through the national headquarters. If any Section desires assistance from the headquarters office in preparing an adequate approach toward this preventive action, it will be gladly given.

## Wisconsin Section Prevents Registration Law Change

Prompt action by the Wisconsin Section has been instrumental in stopping a change in the Wisconsin registration law, promoted by architects, that would have required a special examination to design buildings. The ASCE Section cooperated with the Consulting Engineers Institute of Wisconsin and others to present the position of 6,000 engineers in the state as compared to 600 architects. By promptly presenting the matter to the ASCE Board of Direction at the Cleveland meeting the endorsement of the Society was obtained. With this went instructions that the staff of ASCE assist in Wisconsin, and elsewhere in similar matters, wherever feasible.

The New Jersey Chapter of the American Institute of Architects has brought action against a professional engineer for having designed a country club, claiming that "by so doing he invaded the field of registered architects and exceeded his prerogatives as a registered engineer." ASCE Local Sections are cooperating with other engineer groups to resist this action.

**Russian engineers view foundations for 31-story Western Electric Company Building on lower Broadway in New York. Reuben Samuel, M. ASCE, (in white shirt) project engineer for Crimmins-Slattery, foundation contractor, tells how Western Foundation Corp. is installing drilled-in-caissons to carry up to 2,600 tons on a single unit. General contractor for the structure is the George A. Fuller Co.; the architects are Shreve Lamb and Harmon; and the engineers Purdy and Henderson.**

## ASCE Co-Sponsors Visit of Russian Engineers

Russian soil mechanics and foundation engineers arriving in the United States on May 31 for a summer of study and inspection of U.S. facilities took part in a seminar at Princeton University on June 3, the first of four regional conferences scheduled for the summer. Co-sponsors of the exchange program of engineers are ASCE, the Highway Research Board, and the U.S. National Council on Soil Mechanics and Foundation Engineering. The return visit of the U.S. delegation is tentatively planned for late August or early September.

Of special interest on the Princeton program was a technique for shaking piles into place instead of driving them, described by M. M. Levkin, chief engineer of the Department of Large Bridges. The Russians made their point by showing a film of a golf ball, wriggling in a quart jar of sand and slowly sinking to the bottom. By attaching a vibrator to the top of the pile, Russian engineers make the pile work its way down through the earth, as the golf ball does through the sand. The process works in reverse, too, in getting temporary sheetpiling out of the ground quickly and easily. The vibrating process is said to be five or six times faster than conventional steam hammer methods and cheaper, of course.

Spectacular success with the vibration process was reported in CIVIL ENGINEERING (December 1958, vol. p. 910) by Yi-Sheng T. E. Mao in an article on "The Yangtze River Bridge at Hankow, China." The article states:

"The vibratory driver was made at the bridge site after development of the design from Soviet models. The principle is to have a pair of load-carrying axles revolving at high speed in opposite directions. On each axle is an eccentric weight. When in horizontal alignment, the two weights will balance each other, but when both are in a vertical position they will combine to produce up-and-down vibrating forces. Vibrators have been made with various characteristics. The vibrating force may be 19, 47, 100, or 132 tons; the weight of eccentrics, 6200, 5000, or 6000 lb; the number of eccentrics, 10, 15, or 20; the eccentricity, about 5 in.; the number of load-carrying axles, 4, 6, or 8; the number of revolutions per minute of the load-carrying axles, 408, 450, 900, or 1,000. More powerful vibratory drivers are now being made with a vibrating force as great as 460 tons for installing tubular columns with diameters of 10 ft and 16.4 ft. Two to six open-end 61-in.-dia columns can be sunk every 24 hours, penetrating sand deposits up to 85 ft deep."

Ivan M. Litvinov, of the Academy of Construction and Architecture of the Ukrainian SSR, headed the Russian delegation. The other guests, in addition to Mr. Levkin, were Nikolai A. Tsytovich and Roman A. Takar, of the Academy of Construction and Architecture of the USSR; Alexandr V. Gladyrevskty, chief specialist of Gosstroy (State Construction Commission); and Prof. Vassily M. Bezruk, of the State Highway Research Institute.

Prof. G. P. Tschebotarioff, of Princeton, headed the local committee in charge of arrangements.

# Division Doings

**The Hydraulics Division's Publications Committee met recently in Denver to discuss ways of improving the Division's publication effort. In attendance were (left to right) James W. Ball, chairman; Eugene P. Fortson, Jr.; Harold M. Martin, executive committee member; and Haywood G. Dewey, Jr. Paul A. Parisi, editor of ASCE Technical Publications, met with the group.**

**The Control Group of the Construction Division's Publications Committee got together at the Cleveland Convention. Shown, in usual order, are Al Smoots, of Dames and Moore, Los Angeles; Hal Hunt, editor of "Civil Engineering," New York; Chairman Dan Morris, of TESTlab, New York; Byron Prugh, of the Moretrench Corp., Tampa; Arch Carter, consulting engineer, Minneapolis; and Howard Jacoby, of Photronix Inc., Columbus, Ohio, who is secretary-treasurer of the Construction Division's executive committee.**

**City planners at Cleveland Convention in a session presided over by J. Cal Callahan (left) heard James A. Norton, director of the Cleveland Metropolitan Services Commission, report on what his organization does for Cleveland. Next to Mr. Norton is ASCE Vice-President S. B. Morris, with L. J. Reardon of Case Institute; John Kohl, of the University of Michigan; and Arlie D. Reagon, also from Case.**

## Sanitary Engineering Division

The Sanitary Engineering Division is beating the drum for a more comprehensive annual index—possibly to include the major material in CIVIL ENGINEERING as well as the Transactions for the year. The subject of indexing was one of many discussed at a meeting of the Division's Publication Committee, held in Cleveland on May 3.

Discussion also covered ways and means of expediting the handling of papers; the recruitment of new personnel for reviewing papers; a review of grading standards used in the Division Journal and Transactions; and starting a program of subcommittees for promoting the preparation of good technical papers. I. W. Santry, Jr., is chairman of the Publications Committee.

## Surveying and Mapping Division

In the belief that there are a substantial number of Society members interested in surveying and mapping but not enrolled in the Surveying and Mapping Division (and therefore not receiving the Journal), the executive committee of the Division is taking this opportunity to urge such members to indicate at once their interest and the extent of their willingness to participate in Division activities. After identifying themselves by name, membership grade, address, and business affiliation, they are asked to indicate their opinion of present Division activities, with suggestions for remedial measures or improvement, and to say what technical committees they would like to affiliate with and in what areas of surveying and mapping they are competent and willing to review papers.

Communications should be addressed to:

ASCE Surveying and Mapping Division
Secretary F. R. Gossett, Executive Committee
U.S. Coast and Geodetic Survey
Washington, D. C.

## Errata—Manual on Treatment Plant Design

Attention has been directed to two errors in the recently published ASCE Manual of Engineering Practice No. 36 "Sewage Treatment Plant Design," prepared in cooperation with the Federation of Sewage and Industrial Wastes Associations.

1. On the bottom of page 168, under Type I, the dosing rates should read "between 10 and 30 mgad" rather than "between 10 and 30 mgd."

2. In the middle of page 156 in the reference to Fig. 8, on page 157 within Fig. 8, at the top of page 157 in the reference to Fig. 9, and on page 158 within Fig. 9, the relationship $R = \frac{Q'}{Q}$ is incorrect. The correct recirculation relationship is $R = \frac{Q' - Q}{Q}$.

Readers are urged to notify either sponsoring organization as soon as possible if other errors are noticed. This request is made with the expectation that an errata sheet can be prepared and included in all copies sold after its issuance. Such errata sheets would also be available to those already in possession of the Manual.

## ICA Requests Experience Data From Consultants

As a basic part of its program for engaging professional engineering services by negotiation without competitive price bidding, the International Cooperation Administration maintains an extensive file of information on engineering firms which register with it.

For the convenience of such firms, the Administration has recently issued an "Experience data" form. The form will be used in cataloging information on all firms and individuals who wish to obtain ICA contracts, as the opportunity may arise, in the fields of engineering, management, construction, and the like. The forms will facilitate a review of the qualifications of firms available for the work to be undertaken.

All engineers wishing to participate in the program should fill out the "Experience Data" form and return it promptly. Forms are currently being mailed to all who are registered with the Administration. Others may obtain copies from:

Office of Industrial Resources
International Cooperation
Administration
Washington 25, D. C.

## SOCIETY AWARDS AND FELLOWSHIPS AVAILABLE

**DANIEL W. MEAD PRIZES:** *1960 contest closes May 1, 1960. See 1959 Official Register, page 143.*

**FREEMAN FELLOWSHIP:** *1960-61 (closing date pending). See Official Register, page 154.*

**ERNEST E. HOWARD AWARD:** *Closing date Feb. 1, 1960. See Official Register, page 142.*

**ASCE RESEARCH FELLOWSHIP:** *1960 contest closes March 15, 1960. See Official Register, page 156.*

**J. WALDO SMITH HYDRAULIC FELLOWSHIP:** *1961-62 (closing date pending). See Official Register, page 156.*

## *Terrell Award Presented At Cleveland Convention*

**Aubrey D. May, young member of the Kentucky Section, received the Terrell Award during the Cleveland Convention from Lloyd D. Knapp, ASCE Director for District 9. The Terrell Award was established a few years ago as an essay prize for Junior Members in District 9. It honors ASCE Past-President Daniel V. Terrell, for many years dean of the University of Kentucky College of Engineering.**

### ASCE ENGINEERING SALARY INDEX

**(Prepared Semiannually)**

**Consulting Firms**

| City | Current | Previous |
|---|---|---|
| Atlanta | 1.13 | 1.22 |
| Baltimore | 1.12 | 1.11 |
| Boston | 1.18 | 1.15 |
| Chicago | 1.36 | 1.30 |
| Denver | 1.21 | 1.20 |
| Houston | 1.26 | 1.12 |
| Kansas City | 1.11 | 1.14 |
| Los Angeles | 1.21 | 1.21 |
| Miami | 1.57 | 1.57 |
| New Orleans | 1.03 | 1.21 |
| New York | 1.25 | 1.21 |
| Pittsburgh | 0.95 | 1.05 |
| Portland (Ore.) | 1.16 | 1.11 |
| San Francisco | 1.24 | 1.19 |
| Seattle | 1.06 | 1.06 |

**Highway Departments**

| Region | Current | Previous |
|---|---|---|
| I, New England | 0.92 | 0.89 |
| II, Mid. Atlantic | 1.13 | 1.17 |
| III, Mid. West | 1.16 | 1.25 |
| IV, South | 1.08 | 1.10 |
| V, West | 1.02 | 1.02 |
| VI, Far West | 1.11 | 1.15 |

Sole purpose of this Index is to show salary trends. It is not a recommended salary scale. Nor is it intended as a precise measure of salary changes. The Index is computed by dividing the current salary total for ASCE Grades I, II and III by an arbitrary base. The base is $15,930. This is the total of salaries paid in 1956 for the equivalent Federal Grades GS5, GS7 and GS9. Only the annual base entrance salaries are used in these calculations. Index figures are adjusted semiannually and published monthly in CIVIL ENGINEERING. Latest survey was January 31, 1959.

# The Younger Viewpoint


**Committee on Younger Member Publications**

**Milton Alpern, Chairman; 3536 Northview Ave., Wantagh, L. I., N. Y.**

| Zone I | Zone II | Zone III | Zone IV |
|---|---|---|---|
| Louis K. Walter, Jr.<br>320 Market Street<br>Kenilworth, N. J. | Albert C. Nelson<br>250 N.E. 51st Street<br>Miami, Fla. | Walter D. Linzing<br>4751 No. Paulina<br>Chicago 40, Ill. | Rodney P. Lundin<br>9744 Quakertown Ave.<br>Chatsworth, Calif. |


**On Your Behalf:**

Your interests as younger members of this civil engineering profession are very much the serious concern of ASCE. On June 6 and 7, I had the pleasure of attending a meeting of the Committee on Younger Members. Your problems of professional growth, as well as of the improvement of this page, were considered very conscientiously by Chairman Nomer Gray of New York; and members John Heinzerling of Pittsburgh, Glenn Enke of Provo, Utah, Finley Laverty of Los Angeles, and Frank Edwards of Chicago.

This committee—one of a number in ASCE's Conditions of Practice Department—is constantly working toward resolving situations that are peculiar to younger members of the Society. You, as an Associate member of ASCE, should count on the committee to work on problems that are brought to their attention. (Write to Chairman Gray, c/o Ammann and Whitney, 111 Eighth Ave., New York.)

One of the interesting actions approved by this committee last year was the distribution to all entering Associate Members of the fine "Professional Guide for Young Engineers" kit that has been worked up by the Engineers Council for Professional Development. All new Associate Members will receive the kit. Others may buy it for $1.00 from the ECPD, 29 West 39th Street, New York 18, N. Y.

**Self Appraisal:**

With the thought of the value that comes from self appraisal, we quote, for your use, from the ECPD kit on "Personal Appraisal":

"1. What are the duties and responsibilities of my present position?

"2. Have I sufficient knowledge of my duties and the organization I serve to enable me to do my job well? How should I attempt to gain additional knowledge?

"3. Have I the general education needed to do this job well? If not, what additional educational activity should I undertake?

"4. What additional contributions, beyond the assigned duties, do I make? How can I improve my performance in this respect?

"5. Do I plan my work well and make every effort toward meeting this schedule?"

**To Your Employer:**

Did you know that ASCE has sent a splendid letter to employers of civil engineers urging them to endorse and support the active participation of young engineers in the technical and professional work of ASCE. It is hoped that this action will contribute to the growth of our profession.

**Less Red Tape:**

Those of us who are applying for admission to, or a grade change in, ASCE will be happy to learn that every effort is being made at Society headquarters to speed and expedite the processing of such applications. As you realize, the requirements for admission to our professional society are rigorous. This certainly is as we want it if ASCE membership is to be meaningful to all of us. However, it is certainly a good thing to reduce the time of processing as much as possible.

**To Be or Not To Be . . .?**

There are some who question the propriety of a page such as this. Do you think it appropriate and necessary that the thinking of younger members and their problems be aired on a page like this? Would your occasional needs for communication be met adequately without it?

**Who's Who In Zone I?**

One of the fine young Associate Members of ASCE is going places in Zone I is Joseph DeSalvo who has just been elected president of the Younger Member Forum of the Metropolitan Section. On the technical end, Joe has specialized in soil mechanics. With both extensive practical and teaching experience, as well as graduate education behind him, he is now chief engineer of the consulting firm of Joseph S. Ward. (Joe Ward, incidentally, is another up-and-coming, young-thinking engineer.) Hard working and very personable, Joe DeSalvo has contributed effort in many phases of the work of the Junior Member Forum. He is widely known and liked by his former students and engineering associates who have seen him contribute much time and effort toward the enhancement of his profession.

**On the Money Front:**

The Daniel V. Terrell Award of District 9 sets as the subject for this year's competition: "Can Competitive Bidding Provide Professional Engineering Services?"

In District 8, ASCE Director Howard F. Peckworth writes in the Illinois Section News:

". . . I am concerned about the widespread fallacy that there is a shortage of civil engineers. If there is a scarcity of employee civil engineers in the age group five to thirty years out of college, why then do so many of them rate such low pay in comparison with, say, the medical profession? The answer, of course, is that the medical profession is controlled by doctors who limit the supply at the source, where civil engineering education is controlled by educators, many times not civil engineers. With a minimum of two engineering schools in almost every state, there is always a large supply of the technical graduates, out of which group the professional civil engineers develop . . ."

An interesting commentary on the ASCE Recommended Fee Structure is found in "The Civil Engineer" published by the San Francisco Section of ASCE. A special committee report of its Junior Member Forum, starts off:

"The present suggested fee structure compiled by the ASCE is in need of reevaluation in order that adequate profits may be realized by the employer so that he may properly compensate deserving employee engineers . . ."

There is much more on this that we can publish if you readers would let us know of your interest.

Ground Rules: *Please submit your idea, question, blast or pat on the back, in terse letter form to your appropriate Zone editor. We will consider it for publication with full credit and supply answers where possible.*

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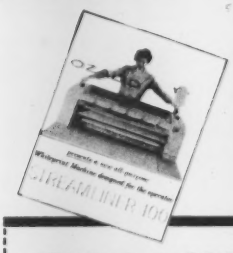

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## Outstanding Civil Engineering Achievement

To increase public awareness of the work of the civil engineer, the Board of Direction of ASCE has established an annual award for "an engineering project that demonstrates the greatest engineering skill, and represents the greatest contribution to engineering progress and mankind." Engineering achievements within the confines of the United States (including Alaska and Hawaii) only are eligible. Nominations for the annual award may be made by members of the Board of Direction, one nomination being permitted from each District.

Civil engineering structures reaching usable completion in the calendar year are eligible. Transportation facilities are eligible when carrying traffic; dams when ready to take the full design head of water; fuel power plants when power goes on the line. Larger projects, such as an airport development, are eligible when a structure or a major feature is operational. Such structures or features must stand on their own in the competition with no consideration for the over-all project. The entire project may be considered for the year's award when it is judged to be 75 percent operational.

For sewage-disposal and water-supply plants where only additional units similar to those already in operation remain to be completed, the entire project may be considered for the year's award when it is 50 percent operational. Military engineering projects are eligible for the award.

Nominations are to be submitted to ASCE Headquarters by the Directors prior to December 1 of the calendar year covering the achievement award. The Directors may ask the assistance of Local Sections in selections, but the nomination may be only for a project within the District. Where a project is within more than one District any or all of them may nominate that project.

Judging will be done by editors of leading engineering magazines. Their decision will be reported to the Board of Direction at the first meeting of the following calendar year for confirmation.

Since the award will be made for outstanding civil engineering achievement, no one engineer but the many engineers who worked on the project will be honored. An appropriate plaque, symbolizing the achievement, will be awarded the owner of the project for permanent display.

Publicity will be given each District's nomination as soon as that nomination is received and as long as it appears to be eligible for the competition. The winning project will be publicized in newspapers, magazines, radio, and television.

## Are You Interested in Nuclear Energy?

With nuclear energy cutting across a wide area of civil engineering interests and activities, the extent to which civil engineers are involved in the field is of immediate concern to the profession. There is no ASCE Technical Division devoted to nuclear energy, though various aspects of the subject are currently being studied by committees in several of the existing Technical Divisions.

John M. Ruddy, chairman of the ASCE Task Committee on Nuclear Planning, would like to have members indicate on this questionnaire the extent of their interest in nuclear energy as it affects civil engineering. By so doing, he says, they will "help themselves and the profession." Please mail promptly.

NAME: ..... MEMBERSHIP GRADE: .....

ADDRESS: .....

NOW REGISTERED IN ..... DIVISIONS

COMPANY NAME & ADDRESS: .....

.....

JOB RESPONSIBILITIES OR TITLE: .....

CHECK AREAS OF TECHNICAL INTEREST:

| | |
|---|---|
| REACTOR CONTAINMENT ..... | WASTE DISPOSAL ..... |
| LAND PLANNING ..... | CONSTRUCTION ..... |
| SAFETY & INSURANCE ..... | STRUCTURE RADIATION DRAINAGE ..... |
| RADIATION SHIELDING ..... | POWER GENERATION ..... |
| OTHER ..... | |
| ..... | |

Send to: JOHN M. RUDDY, Chf. Engr.
Architectural Planning Division
BROOKHAVEN NATIONAL LABORATORY
UPTON, LONG ISLAND, N. Y.

## Professional Services Include Surveying

Recent action by the ASCE Board of Direction stated that the following four major categories in the field of activity commonly designated as surveying or mapping are a part of the civil engineering profession: land surveying, engineering surveying, geodetic surveying and cartographic surveying.

ASCE, therefore, has initiated the same procedures with agencies who invite bids for surveying services as has been followed for agencies using other professional services. Such agencies are asked to discontinue competitive bidding and to negotiate instead.

Government agencies have also been informed that certain surveying services are now held to be professional engineering in the Society's interpretation of the ASCE Code of Ethics. The Society will cooperate to establish a working understanding of the changed conditions.

**ASCE Membership as of June 9, 1959**

| | |
|---|---|
| Fellows | 10,575 |
| Members | 15,162 |
| Associate Members | 17,057 |
| Affiliates | 84 |
| Honorary Members | 47 |
| Total | 42,925 |
| (June 9, 1958 | 41,162) |

# modern concrete design puts "dead" space to work to provide attractive, useful municipal center!

The growing community of Olympia Fields solved more than one problem by choosing concrete for its water tower. The elevated water tank itself is prestressed concrete, 1-million gallon capacity. It is built for years of dependable, trouble-free service.

And supporting the tank on concentric walls of reinforced concrete gives an enclosure with plenty of room to house a compact treatment plant, plus second-floor storage for chemicals and department equipment. The fluted outside wall creates an unusually attractive structure.

It is proposed that the wings will be added later, to be used for municipal offices and a large, pleasant assembly hall. (They would serve equally well as fire and police stations, civil defense or street department offices.) The result will be an efficient, integrated structure of architectural beauty.

Engineers estimate that the combined building will save Olympia Fields real money—as much as $270,000 compared to the cost for separate facilities. And concrete will go on saving money. There will be little or no upkeep, ever. Concrete can't rust, doesn't need frequent painting. When America builds for beauty *and* economy . . . it builds with concrete.

*Consulting Engineer: R. W. Robinson & Assoc., South Holland, Ill. Architects: Wasserman and Cabanban, Assoc., Chicago, Ill. Tank Design: The Preload Company, Inc., New York, N.Y.*

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# NOTES FROM THE LOCAL SECTIONS

*(Copy for these columns must be received by the fifth of the month preceding date of publication)*

The **Central Ohio Section** is currently alerting its membership to three bills pertinent to registration of professional engineers and surveyors which are pending in the Ohio legislature. Cooperating with the Section's officers in opposing passage of the bills are the Ohio Society of Professional Engineers and the Ohio Chamber of Commerce. Consensus of the joint group is that the proposed registration law could be construed "as a revenue-raising measure rather than a law to protect the public.

The annual dinner meeting of the **Central Pennsylvania Section,** held in Harrisburg, on May 13, was a gala affair. Highlight of the evening was a paper on the design details for welded highway and railway bridges by Mark Soto, bridge design engineer with the Harrisburg firm of Gannett, Fleming, Corddry & Carpenter, Inc. During the evening a student paper, "Effect of High Temperatures on Structural Properties of Asphaltic Concrete," was presented by Robert D. Wismer, of Pennsylvania State University. New officers installed for the coming year are Robert H. Klucher, president; John R. Dietz, first vice president; T. Robert Kealey, second vice president; and Hugh B. Henry, secretary-treasurer.

There was a turnout of 127 for the May meeting of the **Colorado Section,** including large contingents of students from the ASCE Student Chapters in the area, who came to applaud fellow students chosen by the Student Award Committee for special recognition. Honored were Gerald Heermann, of the University of Colorado; Laurence Monroe, of Colorado State University; and Yoshio Nago, of Denver University. The program featured an illustrated talk on "The Major Surface Features of the Moon," by L. W. Leroy, head of the Geology Department of the Colorado School of Mines. The University of Colorado Student Chapter has voted honorary membership to Warren Raeder, professor at the University, in recognition of his many years of service and devotion to the Chapter. Presentation was made at the Chapter's annual Ketchum Award banquet.

Professor Taylor D. Lewis, of Cornell University, succeeds William W. Langhorst as president of the **Ithaca Section.** Other officers elected at the Section's May meeting are: Professor John C. Gebhard, first vice president; Glen U. Rothermel, second vice president; and Professor Paul G. Mayer, secretary-treasurer.

Following a tradition of recent years the **Kansas City Section** will sponsor a two-day Construction Conference, November 12-13. Headquarters will be the Continental Hotel in Kansas City, Mo. Conference co-chairmen, Reed McKinley, director of the Public Works for Kansas City, and Ira B. Taylor, assistant regional engineer with the U. S. Bureau of Public Roads, anticipate a large turnout of members from Sections in the area.

An inspection trip to the Corps of Engineers' Bear Creek flood control project on the Lehigh River, near White Haven, Pa., highlighted the May meeting of the **Lehigh Valley Section.** About eighty members seized the chance to study the $11,700,000 project, which is under the supervision of the Philadelphia District. When completed, it will have the largest earthfill dam east of the Mississippi. At the conclusion of the tour, a dinner meeting was held at Split Rock Lodge in the Poconos. Section awards were presented to Robert Coston and Charles Culver, undergraduates in civil engineering at Lehigh University, for submitting the winning paper in the 21st annual Student Chapter Conference held at the University of Pennsylvania in April.

The **Maine Section's** spring meeting, hosted by the Junior Members, was well attended by engineers from Maine, New Hampshire, Vermont and New Brunswick. At the morning session Thomas H. McKaig, New York; Wesley E. Haynes, New Hampshire; and Bryant L. Hopkins, Maine, respectively chairman, secretary, and secretary of their state boards of registration, traced the history of registration laws in the three states and their effect on the profession and the public welfare. Following lunch, J. R. Templeton, of the Nuclear-Chicago Corporation, described and demonstrated the d/M gauge, a nuclear device for the rapid field determination of moisture content and density of soils, concrete, paving and other construction materials.

The annual meeting of the **Metropolitan Section,** held on May 20, covered a lot of ground. Of prime importance was the installation of new officers. The incoming president is Michael N. Salgo, manager of the design and construction branch of the facilities engineering services department of the Columbia Broadcasting System. Gardner M. Reynolds, partner in Dames & Moore, becomes a vice president; Colonel William J. Shea remains treasurer and Brother B. Austin Barry starts the second year of his term as secretary. Another feature of the meeting was a timely discussion on the engineering problems encountered in the current addition of a second level to the George Washington Bridge. Edward S. Olcott, assistant chief of the planning division, Port of New York Authority, presented an illustrated talk on the expanded approaches for the new level while E. L. Durkee, engineer of erection for the Bethlehem Steel Company, enumerated the problems in the erection of the steel framework. This year the Section's annual award of a $50.00 United States Savings Bond for a paper making a distinctive contribution to the civil engineering profession by a Junior Member went to Edward R. Lloyd, of the Royal Liverpool Insurance Group, for his "Insurance Aspects of Nuclear En-

**ASCE Director Philip Rutledge (right, in upper view) presents 1958 Research Prize to Prof. Raymond Mindlin, of Columbia University, during the Metropolitan Section's annual meeting. ASCE Director Thomas Fratar represented the ASCE Research Committee in the ceremonies. In lower view (left) William H. Mueser is named Metropolitan Civil Engineer of the year by Section President Richard Tatlow III. Mr. Mueser, a well known foundation engineer, is a partner in the New York firm of Moran, Proctor, Mueser & Rutledge.**

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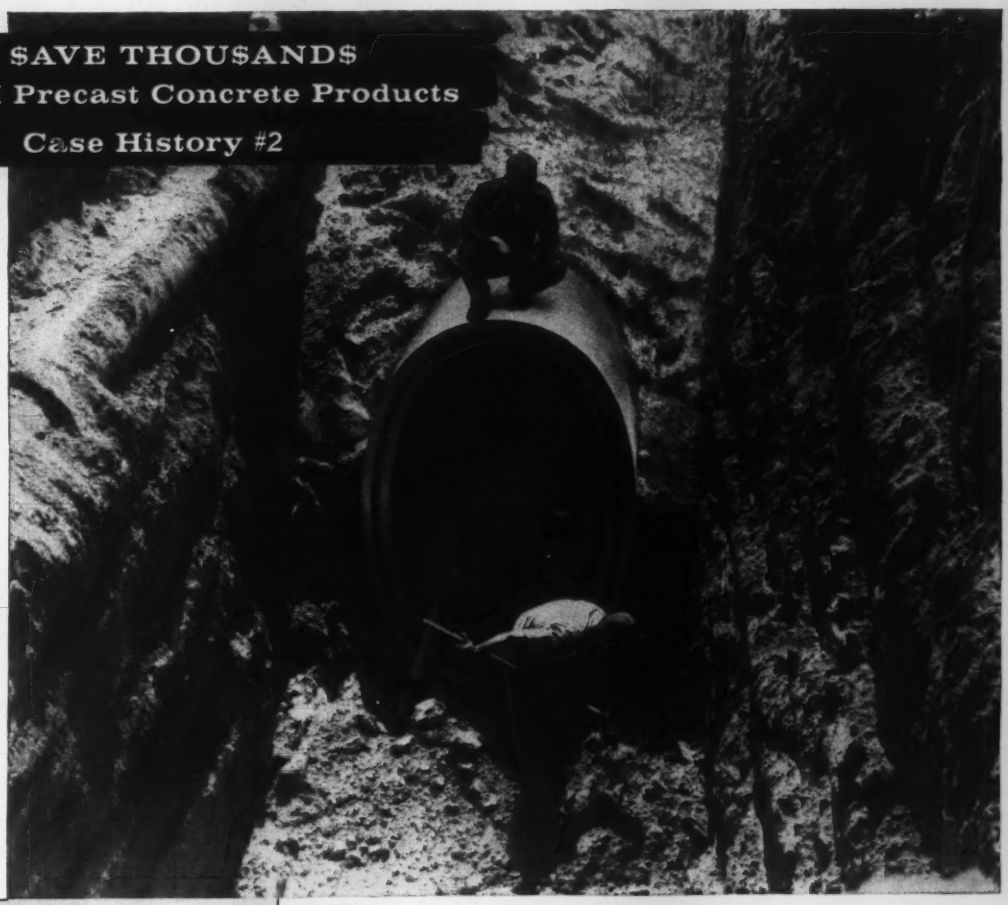

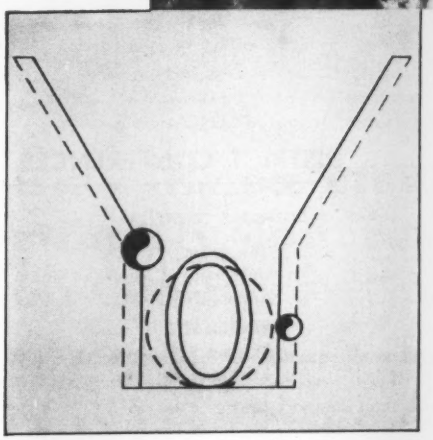

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## A-M HI-HED® PIPE CUTS EXCAVATION COSTS DRASTICALLY!

- 18% narrower than equivalent round pipe, HI-HED Pipe cuts valuable inches from trench widths—can save contractors thousands of dollars in excavation costs.
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ergy." In addition seven outstanding engineer students in the New York area were honored as winners of the Robert Ridgeway Prize, which was established twenty-five years ago to honor the memory of an ASCE past president. The 1959 prize winners and their Chapters are: Irving Wallenstein, Columbia University; Steven Batterman, Cooper Union; Frederick Richards, Manhattan College; John G. Donargo, Newark College of Engineering; George Tomkin, New York University; Arthur Langaker, Polytechnic Institute of Brooklyn; and Joseph M. Casero, Rutgers University.

The program at a recent **Rhode Island Section** meeting was devoted to a seminar "On Hurricane Protection on Narragansett Bay." During lunch Richard Pezzullo, of the University of Rhode Island, presented his award winning paper, "The Moral Responsibility of a Professional Man," which holds that "the education and training necessary to prepare a man for a profession places him in a position of influence among his fellow men," and therefore demands more than the mere mastery of a particular profession. In accordance with the ancients, Mr. Pezzullo said, the public man must exercise the Cardinal Virtues of Wisdom, Justice, Temperance and Courage, and of these Wisdom comes first. For "it is the responsibility of every person whose actions have a direct effect on the well-being of his associates to be not only technically proficient in his own field but also to have an awareness and understanding of the problem of his whole society." The prize, $100, is awarded annually by the firm of Charles A. Maguire & Associates to the best paper selected from Brown University and the University of Rhode Island Student Chapters. Guest speaker at the afternoon session was Gen. Alden K. Sibley.

At a recent meeting of the **Southern Idaho Section** Claude H. Studebaker was elected president for the year ending April 30, 1960. Other officers are Harold D. Hafterson, first vice president; Earl C. Reynolds, Jr., second vice president; Victor E. Hansen, secretary; and Erwin Koessner, treasurer.

The **Knoxville Branch** of the **Tennessee Valley Section** recently sponsored an annual dinner meeting honoring civil engineering graduates of the University of Tennessee Student Chapter. David Goodpasture, an outstanding senior, received the Section's $400 scholarship, while Allen Anthony and Joe Wilkerson will have their entrance fees into the Society paid by the Tennessee Valley Section for their outstanding contributions to the Student Chapter. Guest speaker for the occasion, Berlen C. Moneymaker, chief geologist with the Tennessee Valley Authority, spoke on the geology of the Tennessee River basin.

**General Alden K. Sibley (left), district engineer, Corps of Engineers, was guest speaker on May 16 at a Hurricane Protection Seminar on Narragansett Bay sponsored by the Rhode Island Section. General Sibley is shown at Section dinner with President Harold Bateson.**

## ASCE CONVENTIONS

**ANNUAL CONVENTION**

Washington, D. C.
Hotel Statler
October 19-23, 1959

**NEW ORLEANS CONVENTION**

New Orleans, La.
Jung Hotel
March 7-11, 1960

**RENO CONVENTION**

Reno, Nev.
June 20-24, 1960

## TECHNICAL DIVISION MEETINGS

**IRRIGATION AND DRAINAGE CONFERENCE**

Denver, Colo.
Albany Hotel
August 27-29, 1959

*Sponsored by*
Irrigation and Drainage Division
American Meteorological Society

**SIXTH MIDWESTERN CONFERENCE FLUID AND SOLID MECHANICS**

Austin, Tex.
University of Texas
September 9-11, 1959

*Sponsored by*
Engineering Mechanics Division

**SANITARY ENGINEERING CONFERENCE**

Cincinnati, Ohio
Netherland Hilton Hotel
January 8-11, 1960

*Sponsored by*
Sanitary Engineering Division

## DISTRICT CONFERENCES

**DISTRICT 7 COUNCIL**

Ann Arbor, Mich.
University of Michigan Union
August 7-8, 1959

*Sponsored by*
District 7 Council
Michigan Section

**Participating in recent St. Louis Section panel program on the proposed Metropolitan District Plan of Government are (in usual order) Harry C. Brockhoff, consulting engineer; Section President Henry S. Miller, director of streets, City of St. Louis, who introduced the panel; William Q. Kehr, director, Metropolitan Sewer District; and Donald A. Fischer, dean, School of Engineering, Washington University. The panelists explored the effect of the plan on engineers in private practice as well as on those in public service.**

Ten-ton Blaw-Knox bridge deck form moves on traveler to new position. Steel chains for flr gates are cast integrally with girders. Old River Control Project is a $47 million job designed to preserve Mississippi's flow into its lower basin.

# Blaw-Knox steel forms cut costs, simplify concreting operations on Old River Control Project

Blaw-Knox multi-purpose bridge deck forms used in the construction of the Overbank Control Structure on the Old River Control Project near Simmesport, Louisiana amortized their cost for F&C Engineering Company, prime contractors on the huge project, less than three-quarters of the way through the job.

A three man crew strips and moves the form into position in less than a day. Six additional men align the form and position girder and curb forms which are fabricated on the ground and raised by crane. To date, F&C has averaged one pour every third day.

With this kind of performance, it is easy to see why F&C expects to complete concreting ahead of schedule, at the same time cut job costs. The number of skilled carpenters is greatly reduced, along with material requirements. In your next concrete project, whatever its nature, call in the Blaw-Knox Steel Forms Consultation Service to help in planning for more efficient forming, lower costs, better job profits. There's no obligation, of course.

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# BY-LINE WASHINGTON . . . . .

A congressional uproar last month, about the hiring of Bureau of Reclamation engineers by private consultants for "spare time" work, wasn't unexpected in Washington. The practice has a long history. But there have been some results:

- Possibly most important, new Reclamation Commissioner Floyd E. Dominy reaped some definite plus marks from the Bureau's staff for his stout defense of the organization.
- Orders went out halting the "outside work" for all higher-grade engineers (GS-11 and higher).
- The U.S. Department of Justice is investigating the whole picture, to see if there have been any actual violations of conflict-of-interest statutes.

The charges came out during closed-door hearings on the Bureau's $253.8 million budget, but did not become public until the House Appropriations subcommittee released its 989-page report early in June. In a nutshell, here's what Representative Ben F. Jensen of Iowa brought out:

Ireal Winter, chief of the Hydraulic Machinery Branch at Denver, was employed by J. L. Savage, Hon. M. ASCE, now a Denver consulting engineer, to appear as a witness for the City of Seattle (a client of Savage) before the Federal Power Commission, when the city asked for a power license for its Skagit River development. Mr. Winter was officially on "annual leave" during this employment.

A committee request for names of all engineering employees of the Bureau who have done such "outside" work for consultants since 1945 produced a list of 214 names. Mr. Dominy commented that he was "dismayed" because some of these Bureau engineers had been employed (again by Mr. Savage) on work connected with the proposed $77 million Nebraska Mid-State project—a project on which the Bureau must make recommendations to Congress.

The new Commissioner came strongly to Mr. Winter's defense, calling him a "very valued man," although he added that an official reprimand has been sent to him. "If he (Mr. Winter) is in trouble, the Bureau is at least a party to it," said Mr. Dominy, "it was known that he was doing outside work, and steps were not taken to prevent it." Mr. Dominy expressed no surprise and no real citicism of the prevalence of outside work by Bureau engineering staff members. He attributed it to a severe shortage of qualified engineers.

"As a matter of fact," he told Congressmen, "in this technical engineering field, there are so few people qualified that even the professional engineering societies have not frowned on outside employment of our staff experts. [ASCE did formulate a policy generally contrary to this in 1948. This policy was reaffirmed by the Board of Direction at Cleveland and is printed on page 67 of this issue.]

The Commissioner said that in the case of Shimen Dam, in Formosa, the supply of technical men was so short that the Bureau is now contracting to handle the work with its regular forces, with the consultant (Tippetts-Abbett-McCarthy-Stratton) paying the Bureau. "Maybe," he added, "this is the answer. Maybe skills ought to be made available only by contract (of this kind) . . ."

* * *

A challenge to the right of the Corps of Engineers to force industrial companies to stop blocking a stream channel by dumping wastes—and force the companies to restore channel depths—is now before the U.S. Supreme Court.

The case involves Republic Steel, International Harvester, and Interlake Iron Corp. plants on the Calumet River near Chicago. Corps of Engineers charges say that solid wastes dumped into the river from the plant have progressively decreased the channel depth (set at 21 ft) in some places to 12 and 17 ft. To remedy this situation, the Corps obtained a District Court injunction ordering the companies to halt dumping their waste into the river without a permit from the Corps, and to restore the channel depth and width. But a federal circuit court reversed the injunction, holding that the government has "no statutory or other basis" for seeking the injunction, despite the government's contention that the Rivers and Harbors Act prohibits the obstruction of navigable waters.

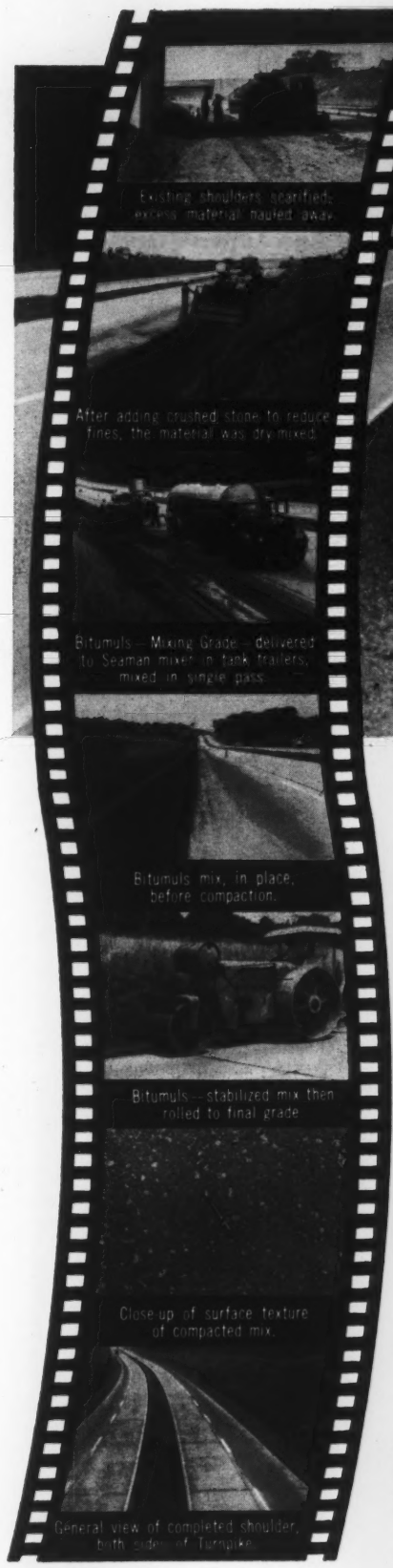
* * *

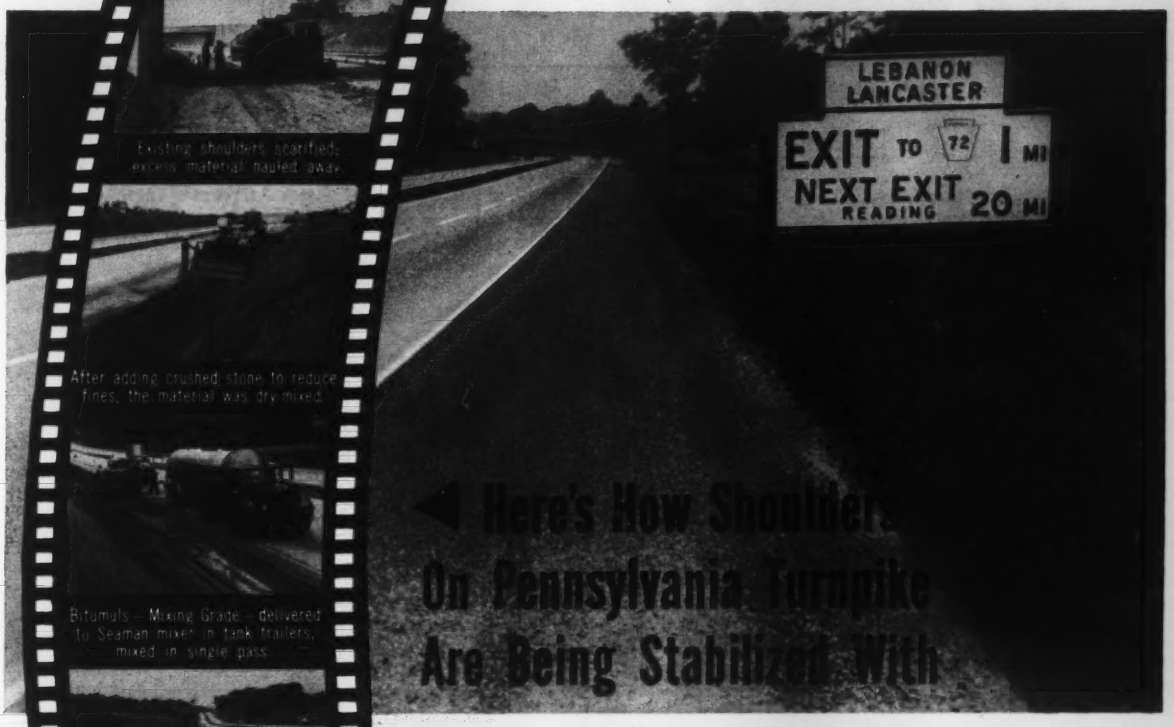
The controversial section of the Interior Department appropriations bill (HR5915) limiting engineering fees to 5 percent of the cost of any project, was knocked out of the bill without debate, when the Senate passed its version of the measure early in June. The section—section 401 of Title IV—caused consternation among engineers when the House approved the measure some weeks ago. It provided that "Not to exceed 5 percent of the cost of any project . . . may be expended for engineering or design of the project" and was construed as a direct slap by the House at the National Parks Service. [ASCE protested the fee limitation in a wire to the chairman of the Senate—May issue, page 76.]

A House-Senate conference committee quickly agreed to dropping the limitation from the bill. However, expressing its concern over engineering costs, the committee directed the Forest Service, National Parks Service, and Bureau of Indian Affairs to bring in a report on engineering costs, when it considers budgets for the 1961 fiscal year.

* * *

That Senate Select Committee on National Water Resources, authorized a month ago, got off to a fast—and politically practical—start in mid-June. Although the resolution creating the group gives it a full two years to complete its survey and recommendations on national water use and conservation, committee members immediately directed their staff to come up with some sort of a practical report no later than July 15, 1960. The reason of course is the impending political campaigns. The bi-partisan committee wants ammunition for party platforms and is well aware that after July 1960, it's going to be difficult to get any Senator to spend much time on water conservation.


Existing shoulders scarified; excess material hauled away.
After adding crushed stone to reduce fines, the material was dry-mixed.
Bitumuls—Mixing Grade—delivered to Seaman mixer in tank trailers, mixed in single pass.
Bitumuls mix, in place, before compaction.
Bitumuls—stabilized mix then rolled to final grade.
Close-up of surface texture of compacted mix.
General view of completed shoulder, both sides of Turnpike.




## Here's How Shoulders On Pennsylvania Turnpike Are Being Stabilized With

# BITUMULS

Proved best by comparative test, Bitumuls emulsified asphalt is now being used to stabilize most of the 132 miles of 8-foot shoulder along the Pennsylvania Turnpike.

The original untreated shoulders were inadequate. In 1955, engineers of the Turnpike Maintenance Materials Department, working with Michael Baker, Inc., of Rochester, Penna., (consulting engineers) took samples and ran tests. Based on their findings, various methods and materials were specified for test-sections of replacement shoulders in 1956.

**Test Results:**

After a winter of service, the test sections were checked and evaluated early in 1957. The Bitumuls stabilized section had performed best, and was specified for the job.

Bitumuls shoulder stabilization is fast and economical (see left). The untreated shoulders are scarified; some material is removed. Crushed stone is added to reduce the fines content, and the material is dry-mixed in place.

Bitumuls delivered by tank-trailer, is pumped, cold, through the mixer. In a single pass the material is mixed and laid, ready for rolling.

Work on the Turnpike shoulders started in 1957 from Mile Post 230 (Gettysburg Interchange) and will be completed in 1959 at Mile Post 296 (Morgantown Interchange).

The size and importance of this Turnpike job sharply underscores one point: Bitumuls provides adequate stability for long-lasting, heavy duty shoulders at low cost!

Call our nearest office for additional information.

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Inglewood, Calif.
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BITUMULS® Emulsified Asphalts • CHEVRON® Paving Asphalts • LAYKOLD® Asphalt Specialties • PETROLASTIC® Industrial Asphalts

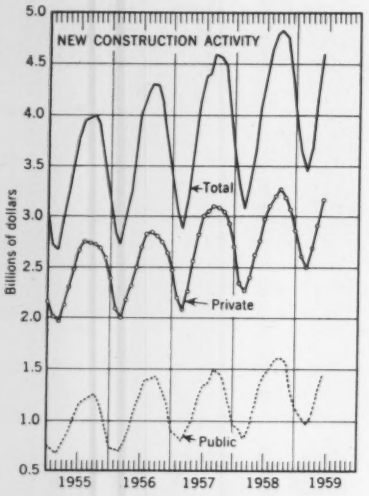
# NEWS BRIEFS . . .

## May Construction Activity Sets Record for the Month

New construction activity increased seasonally in May, bringing the total of work put in place to $4.6 billion. This was 15 percent above the May 1958 total and set a new record for the month, according to preliminary joint estimates of the U. S. Departments of Commerce and Labor. On a cumulative basis, expenditures of $19.7 billion for the first five months of 1959 were 13 percent above the comparable period of 1958, also setting a new high for the period.

Private construction outlays of $13.9 billion reflected increased spending for work on new housing, which was 36 percent above the same period last year. In the public sector, total expenditures of $5.8 billion through the end of May 1959 were 16 percent above the previous January-May high reached last year. Most of the public construction types contributed to this record, with the notable exception of educational building, which was 3 percent under the 1958 total for the first five months.

The monthly estimates of the joint agencies are determined primarily by past contract award movements, standard progress patterns, and assumed normal seasonal movements. Except when special surveys are made, the estimates do not reflect the effects of varying numbers of working days in different months, nor of special conditions influencing the volume of activity in any given month, such as unusual weather, materials shortages, overtime, work stoppages, and postponements.




**New construction activity in May rises to $4.6 billion—15 percent above the May 1958 total. This total also set a new record for the month.**

## Yukon Basin—Biggest Hydroelectric Project Ever

**Specialists in the Alaska District of the Corps of Engineers are studying Rampart Canyon on the Yukon River northwest of Fairbanks as a possible site for a dam and hydroelectric plant haing a record potential of 4,700,000 kw. The dam would create a reservoir covering 10,000 sq miles—10 percent larger than Lake Erie. Fifteen years of average Yukon flow would be required to fill this tremendous reservoir.**

## Stockholm Pushes Jet Age Airport

To accommodate its steadily increasing international jet passenger traffic Stockholm is pushing work on a new $45,000,000 airport. First ground for the project was broken in May 1958, and it is scheduled for completion by the end of 1959. To be called the Arlanda Airport—after an ancient community in the Stockholm area—the project features a 1½-mile-long runway. Later the length of the runway will be increased to 2 miles. The project involves the blasting and removal of 593,000 cu yd of rock and the handling of 1,780,000 cu yd of gravel for fill under concrete surface.

The Arlanda Airport also involves an allied project—construction of a 25-mile superhighway connecting Stockholm with the airport. This project will cost $14,000,000. At present transatlantic traffic is served by a two-lane highway connecting Stockholm and Bromma Airport, which is nearer the capital than the Arlanda field.

In competition with a number of foreign firms, the Swedish firm of contractors, Skanska Cementgjuteriet (Scanian Cement Foundry), was given the contract for laying out the field. The varied-type terrain includes rocky hills, forest land, and boggy or clay-based areas. One of the major problems was the draining of the clay-based parts of the field, which has been solved by use of sand drains spaced about 4 ft apart.

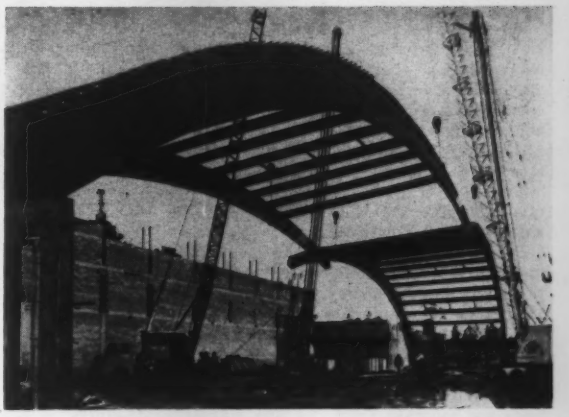
Methods developed by the Swedish drilling machinery specialists, Atlas Copco, have rendered the large blasting operations both fast and simple. One man handling two fully automatic stope drills can bore holes of a combined length of 660 ft per shift. Fifteen compressors, the largest with a capacity of 630 cu ft of air per minute, are being used with 65 rock drills. The drills are equipped with an air cylinder for automatic feeding of the Cormorant-tipped steels.

Some 13,000 cu yd of earth is moved every day to level the field. About 450,000 sq yd of 9-in.-thick concrete will be laid for runways and taxiways. A 500-ton daily capacity asphalt plant will provide additional surfacing material. The investment in machinery is reported to be $3,000,000, exclusive of rented vehicles for transportation.

*[Editor's note: The material for this item was supplied by Holger Lundbergh, of the American-Swedish News Exchange, New York, N. Y.]*

## *Glued Laminated Timbers Used for Sports Arena*

**Glued laminated timbers 11 in. wide, varying in depth from 36 in. at the abutment to 66 in. near the quarter points and narrowing to 30 in. at mid-span serve as arches for a 252 ft Jai Alai arena being completed at Volusia, Fla. The three hinged arches rise 67 ft 4 in. from the abutment to the center pin. Because of shipping limitations it was necessary to splice the half arches at the center point after shipment from the plant of American Fabricators Inc. at Bellingham, Wash. A basic wind velocity of 45 mph at 30 ft above the ground was used in the design. The area was designed by Francis R. Walton, architect of Daytona Beach, with Oboler and Clark of Miami Beach as structural engineers. Thomas and Slater, Inc., of Daytona Beach, was the general contractor.**



## EIC Annual Meeting Features Canadian Projects

Papers presented at the 73rd annual meeting of the Engineering Institute of Canada, held in Toronto, June 8-10, covered a wide range of Canadian interests and activities. Though the St. Lawrence Seaway is being dedicated this June and much of the St. Lawrence power output has already gone on the line, the great seaway-power project will intrigue engineers on both sides of the river for a long time to come.

Some of the "exceedingly complex construction problems" solved in building the International Rapids section between Cornwall and Prescott were reviewed by K. A. Henry, river control engineer, who directed all operations pertaining to river level and flow—an especially important role in the July 1958 flooding of the area.

A. T. Edwards, of the Hydro-Electric Power Commission of Ontario, reported on studies of the effect of blasting on neighboring buildings during the demolition of structures necessitated in building the Seaway. The joint studies were made by the National Research Council and the Hydro-Electric Power Commission of Ontario, assisted by the director of the St. Lawrence Power Project. Commenting on the results of twenty-two blasts set off in the vicinity of the six buildings selected for the experiment, Mr. Edwards said, "the St. Lawrence work indicates that damage is likely to occur with a velocity of 4 to 5 in. per second. A safe limit of 2 in. per second is recommended."

W. G. Holt, general manager of the Mechanical Division of the Dominion Bridge Company, described the work involved in the design and erection of six vertical lift bridges spanning the Seaway in the Montreal area. Mr. Holt remarked that the design, fabrication, and erection of these lift bridges were accomplished in a race against time in order to have them ready for the opening of navigation on the Seaway this June. He said that it had been nearly twenty-five years since a major lift bridge was built in Canada, and many U. S. bridges were inspected before work could start. He attributed the success of the project to the high degree of cooperation existing between the canal, railroad, and engineering authorities.

With the smaller Canadian harbors hoping to share in the increased trade the St. Lawrence Seaway will bring, the silting of Lake Ontario "is a very serious matter," Dr. A. Brebner, of Queen's University, said in his paper. With the exception of Hamilton and Toronto, the harbors on the north shore of Lake Ontario can accommodate ships of little more than half the draft permitted by the Seaway. The beach erosion causing the silting is now being studied in a double-barreled program of investigation and field measurement set up by the Department of Public Works, the National Research Council, and Queen's University.

Canadian power developments also loomed large on the program. Among the projects treated were the recently completed submarine cable link between the British Columbia mainland and Vancouver Island; the current project for connecting the power systems of Nova Scotia and New Brunswick; the Brandon, Manitoba, generating station; and construction of a two-mile tunnel for power transmission in connection with the Silver Falls, Ontario, generating station.

In a talk on "Precast Concrete for Winter Building," A. W. Smith, of the National Research Council, Ottawa, deplored "the dearth of information on joint design in the offices of engineers and architects and the lack of a handbook on standard sections for even floor and roof panels."

New elections to honorary membership include John B. Stirling and James A. Vance, Fellows ASCE, both former presidents of the Institute. At the close of the meeting J. J. Hanna, of Calgary, Alberta, was installed as president for the coming year. Kenneth F. Tupper, of Toronto, is the retiring president.

## *Painting the Pulaski Skyway*

**The Pulaski Skyway—a massive pair of connecting bridges spanning the marshlands and waterways between Newark and Jersey City—is being painted for the first time since 1946 and for the second time since it was completed in 1932. The 3½-mile span rises to an elevation of 100 ft over the marshes and 130 ft above the Hackensack and Passaic rivers. Before it was opened automobile traffic into New York from New Jersey was often backed up for many miles waiting for drawbridges to close. The trip from New York to Newark Airport customarily took an hour and 40 minutes, and the New York-Philadelphia trip was an all-day expedition. The New Jersey State Highway Commission has awarded the painting contract to J. I. Hass, Inc., of Jersey City. The cost of the project is about $500,000.**

## Jet Age Building Program for International Airport

The decentralized Terminal City at New York International Airport (Idlewild) is being constructed to accommodate 16,000,000 passengers by 1965. Under construction currently are huge individual terminals for Eastern, United, Pan American, American and Trans-World airlines.

The Port of New York Authority has invested more than $220 million in the airport since taking over from New York City in 1947, after the City had spent $60 million on runway and utility installations. The budget for construction at the airport in 1959 amounts to $75 million and includes hangars, runway extensions, and lighting modernization as well as the terminals for individual airlines.

The terminals for the American flag lines are separate from the $30 million International Arrival and Airline Wing Building opened in December 1957. All passengers arriving from other countries pass through this building, and 21 foreign-flag airlines serve departing overseas passengers from this area.

In August Eastern Air Lines will open a terminal for its own use, with a passenger concourse larger than that in Grand Central Terminal or Pennsylvania Station in New York City. The main lobby has 29,000 sq ft of uninterrupted open floor space. Separate floors are provided for incoming and outgoing passengers; underground pipelines provide for hydrant fueling of aircraft. This building for an individual airline has its own control tower for plane traffic and a control tower inside the huge lobby for passenger traffic.

United Airlines is rushing to completion a $14,500,000 crescent-shaped terminal with glass and aluminum facades. In the first stage of construction, the terminal will accommodate 2,000 passengers a day and provide facilities for thirteen DC-8 jet planes as well as for propeller-driven planes.

About 90 percent of the steel work has been completed on the $10 million three story umbrella-type Pan American Airways passenger terminal, due to open early in 1960. The four-acre concrete and steel roof, large enough to cover Yankee Stadium, is hung from 32 steel girders fanning out from a central core, each supported by six 2½-in.-dia cables. The front door will be a 90-ft opening protected by a curtain of moving air, which permits ready passage of pedestrians with luggage but keeps out weather and insects.

A telescopic passenger corridor at second-floor level to conduct passengers from the departure floor directly to the airplane without making them climb steps is a feature of American Airlines' customer-centered $14 million passenger terminal, scheduled for completion in early 1960. Like the other terminals, it will be completely air conditioned. The American hangar will have the longest expanse of stained glass in the world, a 320-ft length, 23 ft high to serve as the south facade of the structure.

Ground has just been broken for the Trans-World Airlines' terminal that will be a vast shell-concrete structure whose bold form suggests the flight of a giant bird, as shown in an accompanying photo.

**Major U. S. airlines' terminals currently under construction at fast-growing New York International Airport are indicated here on aerial view of the 655-acre Terminal City. The upper photo shows in artist's sketch the huge shell-concrete structure, suggesting the flight of a giant bird, which will be the terminal for Trans-World Airlines.**

## Maryland Starts Study of Steel-Reinforced Roads

A basic and applied research project to study steel-reinforced concrete roads will be undertaken jointly by the Maryland State Roads Commission and the University of Maryland, in cooperation with the U. S. Bureau of Public Roads. The study, which is expected to lower the cost of road maintenance in the state and provide a smoother ride, will seek to establish a criterion for road design, pavement thickness, and the amount of steel reinforcement required to eliminate expansion and contraction joints.

Plans call for the construction of nine different experimental sections along a five-mile stretch of the Baltimore-Harrisburg Expressway. The sections, now under construction, are built of concrete with varying amounts and patterns of steel reinforcement.

The project is under the direction of Prof. C. T. G. Looney, F. ASCE, head of the university's department of civil engineering; H. A. Lepper, Jr., F. ASCE, professor of civil engineering; Norman M. Pritchett, F. ASCE, chief engineer for the Maryland State Roads Commission; and Allan Lee, research engineer for the Commission. The basic research in the university laboratories will be handled by graduate students.

## Armco Steel Expands Its Stainless Steel Facilities

As part of the expansion of its Butler (Pa.) Works, the Armco Division of the Armco Steel Corporation is beginning a $17,000,000 program for additional stainless steel facilities. Contracts are being awarded for the installation of new machinery and equipment and building improvements for a new Butler Works unit to be known as Plant No. 2. Stainless steel production equipment, now in Plant No. 1, will be relocated in the new unit.

The entire project, to be completed late next year, will enable the production of wider close-tolerance stainless steel sheets and coils. Such sheets and coils are now in wide demand in the construction of high-speed jet aircraft.

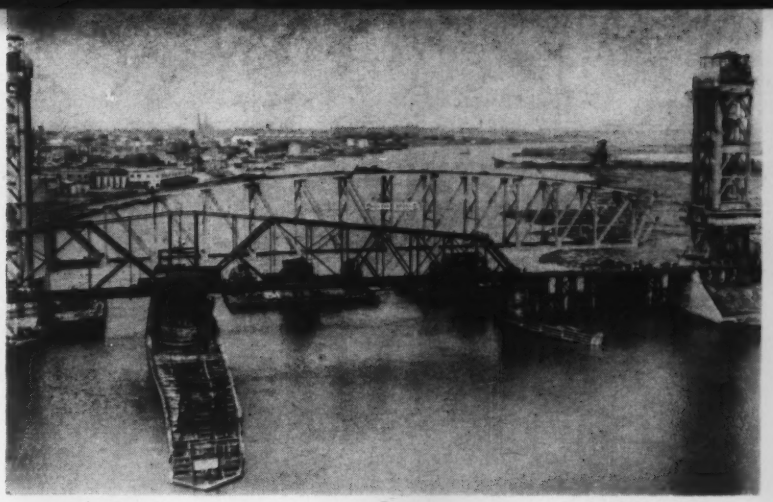
The Rust Engineering Co., of Pittsburgh, has been awarded the construction contract.

(Vol. p. 516) 

## Port of Manila To Be Modernized

Historic Manila Bay is in for a multi-million-dollar face lifting. The Philippine government has just engaged Rader and Associates, engineers and architects of Miami, Fla., to undertake expansion and modernization of all shipping facilities at the Port of Manila. The $14,000,000 improvement program will include dredging the channel and turning basin. Already on the job in Manila for the firm is Brig. Gen. Robert G. Lovett, F. ASCE (U.S. Army retired), whose first overseas command was on Corregidor.

With a shoreline of 120 miles, Manila Bay is one of the world's largest land-locked harbors. Increasing commerce, sparked by free-trade relations with the United States, and the rapid development of Philippine mining, hydroelectric power, and industry have made the expansion program a must.



### *World's Longest Vertical Lift Spans Arthur Kill*

**On July 15 the world's longest vertical lift span, connecting Staten Island and New Jersey over the waters of the Arthur Kill, will be opened. Here the American Bridge Division of U. S. Steel is seen placing the final section for the new bridge. The 560-ft. 2,000-ton span was moved on three barges from a Staten Island dock to the bridge site. Steel for the span was fabricated in the Bridge Division plant at Ambridge, Pa., and then shipped by rail for assembly at Staten Island. The bridge, which is used by the Staten Island Rapid Transit Company, a wholly owned subsidiary of the Baltimore and Ohio, replaces an obsolete structure.**

## Government Has Available Basic Data on Water Use

Of concern to engineers and planners are the basic data on water use collected by the Federal Government during the past decade. In 1948, in response to the long-felt need of the nation's industries and water resources development planners, interested Federal agencies began the collection, assembly, and publication of pertinent data. One of the agencies that has been primarily concerned with development of such a program is the Water and Sewerage Industry and Utilities Division, Business and Defense Services Administration, U. S. Department of Commerce. Walter L. Picton, M. ASCE, is director of the Division.

Since 1950 the Water Resources Division of the U. S. Geological Survey has made, at five-year intervals, an approximate survey of the entire nation to obtain estimates of water use; surveys of water use in the major metropolitan areas (the program will include about 100 such areas); and surveys of selected industries and products in order to ascertain the volume of water used in making the products. Results of the surveys of metropolitan areas are published in the series of Geological Survey Circulars entitled "The Water Resources of the——Area." Results of the industrial surveys are available in Geological Survey Water Supply Papers, entitled "The Water Requirements of the——Industry."

More recent developments include the formation of the President's Interagency Committee for Water Resources, composed of Cabinet members. Under this committee a Hydraulics Subcommittee has been established, and under the subcommittee there is a Task Group for Water Use Data. Mr. Picton is Department of Commerce representative on this Task Group, which has just completed an inventory of all Federal agency collections of water use data for submission to the Hydraulics Subcommittee.

An ambitious program of surveys for the years 1959 and 1960 has been recommended by Federal and industrial task groups. At present it appears that many of the recommendations will be incorporated in the 1959-1960 censuses. Among these will be the Census of Irrigation, the Census of Agriculture, the Census of Manufactures and Mineral Industries, and the Census of Housing. Recommendations also call for surveys by the Federal Power Commission on water use in both the steam and hydro generation of power by the electric utilities; surveys by the U. S. Public Health Service on major public water supplies and major public sewerage utilities; and a Department of Defense resurvey of water and sewerage facilities.

## Ground Broken for Central Utah Project

Construction of Stanaker Dam, principal feature of the Vernal Unit of the Central Utah Project, got under way in a colorful ground-breaking ceremony held on May 14. Speakers included Assistant Secretary of the Interior Fred G. Aandahl, of Washington, D. C., and George D. Clyde, F. ASCE, governor of Utah. The work at Stanaker Dam was begun under an initial $1.6 million contract awarded to the Morrison-Knudsen Co.

The ceremonies marked the start of work on the Vernal Unit, a project for bringing urgently needed additional water from the Upper Colorado to some 1,500 acres of irrigated lands, which suffer from water shortages. The Vernal Unit is the first to be undertaken in the $240,000,000 Central Utah Project, which will be built over the years under the auspieces of the U. S. Bureau of Reclamation.

## ICOLD Committee Meets in Finland

Experts on large dams from some forty countries have been in Helsinki, Finland, attending the twenty-sixth meeting of the executive committee of the International Commission on Large Dams. Following the Helsinki meeting, May 30-June 2, the group participated in a study of several dams and hydroelectric power stations. The tour, which ended in Stockholm on June 12, took the delegates to projects north of the Arctic Circle in Finland and in eastern Sweden.

The United States delegation was headed by Gerald T. McCarthy, F. ASCE, chairman of the U. S. Committee on Large Dams and partner in the New York firm of Tippetts-Abbett-McCarthy-Stratton. The other delegates were Frank M. Clinton, F. ASCE, regional director of the Bureau of Reclamation at Billings, Mont., and Martin Friedman, Jr., consulting engineer of Norfolk, Va. William T. Lerch, chief engineer of the Portland Cement Association, Chicago, was alternate delegate.

# EXAM GEMS

*by*

*Reggie Strashn*

*Editors' Note: With this issue R. Robinson Rowe, F. ASCE, abandons the role of Sphinx (or N. G. Neare), in which he has delighted puzzle lovers for almost twenty years, in favor of a new department. Each month, under the pseudonym of Reggie Strashn, Mr. Rowe will present one of the significant problems used by registration boards—a service that should be especially helpful to younger members and of interest to all. The Editors of* CIVIL ENGINEERING *take this opportunity to thank N. G. Neare for the preparation every month of copy and the handling of all correspondence concerning the column—without pay. Copy has always been on time, and, so far as can be remembered, there has never been an error in the column. Mr. Rowe, who recently completed a three-year term as Director of ASCE, will retire this fall as principal bridge engineer for the California State Division of Highways. The first problem in the new series of "Examgems" follows.*

**R. R. Rowe**

Under this telescoped headline, CIVIL ENGINEERING will bring to its readers an edited series of "civil engineering examination gems," selected from problems actually used by registration boards.

To be eligible for selection as an examination gem, a problem must be unusually adaptable to the purpose of measuring the qualification of a candidate for registration. Examinations are not competitive, but aim at "separation of the men from the boys," that is, at measurement of professional maturity.

Obviously academic or textbook problems would fail in that purpose, for otherwise engineering graduates could achieve registration without experience, and experience thru some sort of internship is obligatory in all learned professions.

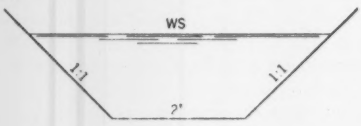
In contradistinction, the professional problem must require professional thinking on a practical assignment. It may, for example, contain too many or too few data and require the candidate to delete redundant or supply missing information, as he will often do on professional engagements.

**Our first "Examgem" given by California in June 1955, contains such elements. Although the first part could be called academic, examiners could detect a professional touch in set-up of the cut-try solution. Assuming that your answer was 3.33 ft, how would you solve the second part? Solution and discussion will appear next month.**

Nominations for future "Examgems" will be considered only if quoted verbatim from an actual examination and accompanied by solution and discussion with permission to edit.

Examgen No. 1—The log flume.

*Given:* The Yreka Logging Company has constructed a flume of the dimensions shown, having a flow of 265 cfs and a roughness coefficient of 0.020.




*Wanted:* 1. If the slope of the energy gradient is 2.25 percent, determine the depth of water in the flume.

2. What maximum-sized log, with a specific gravity of 0.66, will float in the flume when the ratio of the diameter above water to the radius of the log is 075?

---

*In the following—his 231st (and last) column as N. G. Neare—Mr. Rowe gives the solution to the problem of "how wide a river a Djin could cross on a 70-ft rope," propounded in the May issue.*

"For the last time, Joe," quizzed Professor Neare, "what do you know?"

"What do you mean, 'for the last time'?"

"I mean this is the 231st and last meeting of the Engineers Club of Esseyeville, and do you know the answer to our last problem of how wide a river a Djin could cross on a 70-ft rope?"

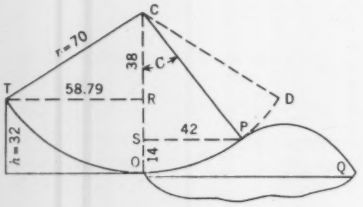



**Fig. 1. with takeoff at T, Joe let the Djin drop from D, but Cal shot him from P to Q.**

"Well, then, Professor, thanks for making the last one easy. In the sketch (Fig. 1), the 70-ft rope hung from a limb $C$ to the river bank at $O$ and the Djin pulled it back to the take-off $T$ at the top of a 32-ft platform. Since his swing would carry him to the drop point $D$ at the same height, all I had to do was solve triangle $CRT$ and find 58.79 ft for the width of river."

"Maybe Cal . . . ."

"No 'maybe' about it," sputtered Cal Klater. "The Djin, if properly en-djinneered, would let go at some point $P$ and shoot on a parabola to the far bank at $Q$. I expressed the parabola with respect to an origin at $O$:

$$x = r \sin C + 2u \cos C \sqrt{h - r \text{ ver } C}$$

$$y = r \text{ ver } C + 2u \sin C \sqrt{h - r \text{ ver } C - u^2} \quad (1)$$

where $r$, $h$ and $C$ are as shown on the sketch and $u^2 = \frac{1}{2}gt^2$. To locate $Q$, I let $y = O$, solved for $u$, and derived an equation for $x$ in terms of $C$. It was a bit messy, so I found the maximum by trying successive values of $C$, ending up with $x = 89.73$ at $C = 37°$."

"That's close enuf, Cal, but that messy expression for $x$ leads to a very neat relationship for the maximum,

$$h_P = h \tan^2 C = h - r \text{ ver } C \quad \ldots \quad (2)$$

where $h_P$ is the kinetic head at $P$, measured by $RS$ on the sketch. This leads to a cubic

$$r \cos^3 C - (r - 2h) \cos^2 C - h = 0 \quad (3)$$

but the substitution $r = 70$, $h = 32$ makes it favorable

$$(7 \cos^2 C + 5 \cos C + 4)$$

$$(5 \cos C - 4) = 0 \quad \ldots \quad (4)$$

so that $\cos C = 0.8$, $u^2 = 50$, and

$$x_{max} = r \sin C + 2h \tan C \quad \ldots \quad (5)$$
$$= 42 + 48 = 90 \text{ ft}$$

"I should add," concluded the Professor, "that the djineros were as careful as modern engineers. To make sure that each Djin dropped from the flying ferry at precisely the right point, they rigged a tag line so that the ferry stopped there suddenly and the passenger obeyed the djinero's second law of motion, later ascribed to Newton."

*[Cal Klaters were German Gurfinkel, Ed C. Holt Jr and Dana E. Low. Also acknowledged are solutions to the April Tightwad Problem from C. W. Trigg, M. L. Pei, Robert H. Cummings, Harry G. Wenzel Jr., and Ab Stract (Manuel A. Benson). Altogether, thru the 19 odd years, 361 were named Cal Klater; one made the grade 126 times. There were 135 other correspondents confidentially known as Joe Kerr. The most popular problem drew 26 correct solutions. In closing, Prof. N. G. Neare expresses again his thanks to all the Joes and Cals for their friendly and often whimsical correspondence, his only but very satisfying remuneration.]*

This is the Brays Bayou Channel Paving Project in Houston, Texas, being constructed by OTCO, Contractors, of Houston.

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## Scroll Case for Tuscarora Plant Pump Turbine

**Assembly of the scroll case to the stay ring for one of twelve reversible pump-turbines for the New York State Power Authority's Tuscarora Plant is shown underway at Allis-Chalmers West Allis (Wis.) Works. The largest scroll case for a reversible pump-turbine in the United States, the unit has an 18-ft-dia inlet and measures 56 ft across. The pump-turbines will provide greater combined capacities than any other similar plant in the world, with each rated 28,000 hp under a 75-ft head as a turbine and 3,400 cfs against an 85-ft head as a pump.**

## Steelwork Completed for Manhattan's First Motel

**Completion of the 400-ton steel frame for Manhattan's first motel was marked by topping-out ceremonies on May 8. City and industry officials taking part in the program included Hulan Jack, Borough president of Manhattan (right), and Harold Steinberg, president of the Downing Management Corp. Located in the heart of Manhattan—at Tenth Avenue and 49th Street—the $1,500,000 building is five stories high and will have 130 rooms and parking space for 130 cars. The layout is such that guests will be able to drive into the lobby to register and unload luggage. The architect was Leo Stillman; the structural engineer, Weinberger, Froeman, Leichtman & Quinn; and the general contractor, the Diesel Construction Corp., all of New York. Steel was fabricated by Simon Holland & Son, Inc., of Brooklyn.**

## Subscription Plan for AEC Engineering Drawings

The Cooper-Trent Blueprint and Microfilm Corporation, of Arlington, Va., the Atomic Energy Commission's prime contractor for filming unclassified engineering drawings and related specifications, in conjunction with the Commission's Civilian Application Program has announced a Special Subscription Plan for reproduction of this significant source material.

Over 20,000 engineering drawings and related specifications have been filmed to date by the Micro-Master 105-mm film system, and it is expected that an additional 6,000 drawings will be filmed by the end of the year. Selection of complete packages of drawings can be made from the 38 categories listed in the AEC publication, Supplement No. 2 to the *Engineering Materials List*.

After selecting specified categories, customers will receive complete sets of 105-mm Duplicate Foils (4 × 6 in.) in an indexed envelope for all material specified. In addition, they will automatically receive copies of all new source material as soon as filming is completed. The cost of the Subscription Plan for a period of one year is 35 cents per Foil (22 percent less than the list price). The Foils are useful visual aids for immediate viewing in order to select full-size projection prints.

Free information on more than 400 different sets of plans is available from Cooper-Trent, 2701 Wilson Boulevard, Arlington, Va.

## Air Defense Contract Awarded to Vitro Company

A $2.2 million Air Force contract for operation and maintenance of power facilities for SAGE-Bomarc bases in the Northeast Air Defense District has been awarded to the Vitro Engineering Company, a division of the Vitro Corporation of America. The contract includes operation and maintenance of SAGE power facilities at major Air Force bases in New York, New Jersey, Maine, and Virginia, plus the training of Air Force personnel in the operation of Bomarc power facilities.

SAGE (Semi-Automatic Ground Environment) is an automatic control, dissemination and display system which employs digital computers and their ancillary transmitters and receivers to coordinate the many components of the country's air defense system.

In the past seventeen years the Vitro Engineering Company has designed more than $1 billion in facilities for government and industry, including the gaseous-diffusion plants at Oak Ridge for the separation of uranium isotopes and Consolidated Edison's 275,000-kw nuclear power station now under construction at Indian Point, N. Y.

# Some Ideas

for your file of practical information on drafting and reproduction from

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Frankly, we hope you're a fusspot. If you are fussy about the way you work, and proud of it, we think you'll enjoy knowing about three K&E items which reduce the effort required to get pin-neat results. Our first suggestion is . . .

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For effortless drafting, a good board cover is about as important as a good mattress is for sound sleep. Which is why so many draftsmen swear by LAMINENE® (N 70), the only *laminated* board cover material made. An exclusive, patented K&E process gives LAMINENE several very practical advantages over plastic coated papers. You can stretch it, drumhead-tight, over your board. All you do is wet the back, then secure the ends by taping or stapling to the underside of the board. After drying, LAMINENE grips the board as if cemented—there's no rippling, no stretching with the weather, no slack to take up. Its "drafting feel" is perfect: just the right balance of firmness and resiliency. LAMINENE'S non-glare surface makes it easier on the eyes, too, even under fluorescent lighting. You can expect to leave the board feeling fresher, even after a long day.

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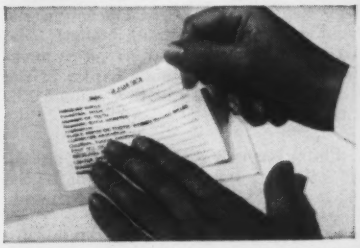
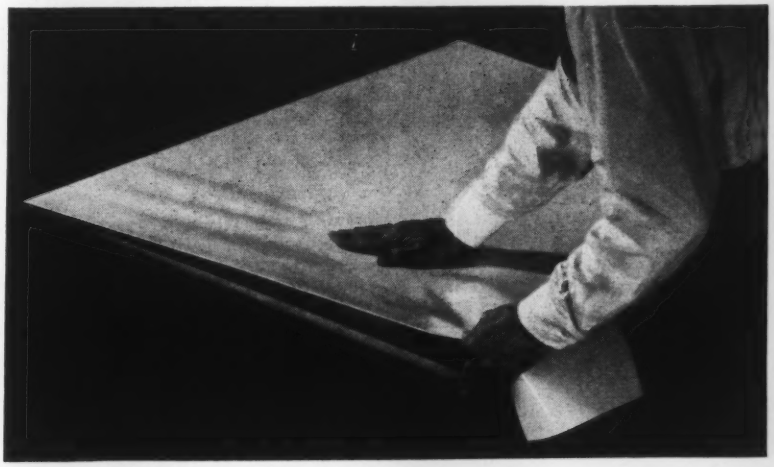
Want to eliminate a time-consuming chore? You can cut down on tedious repetitive lettering by having title blocks, specifications, and other symbols or legends printed



—clearly and sharply—on DULSEAL™ (74). This tissue-thin film has a delayed-action adhesive on the back, and a dull-finish face for easy writing or printing. Stickers made of Dulseal can be firmly positioned—and re-positioned hours later, just as firmly. The adhesive takes 24 hours to set. Once it does set, a permanent bond is formed with the paper or cloth beneath. Dulseal is chemically stable, and the adhesive will not bleed, even in hot copying machines.

Repeated erasures on Dulseal will not affect its "take." Produced by an exclusive process, the "tooth" is *built into* the surface. Transparent and low in reflectivity, Dulseal stickers will not affect the transparency or printing speed of your drafting medium. K&E supplies Dulseal in sheets, rolls (printed to your specifications if you wish), and as a mending tape in a handy dispenser. Try a sample, on us!



### 3 To Keep Clean

Best way to keep your tracings clean: don't let them get dirty. A mighty easy way to achieve this is to sprinkle the tracing lightly with gum eraser particles, while working. Then, triangles, T-squares, and scales stay clean, and clean the surface *automatically*, as they are moved back and forth. The particles will not dry out or harden—they contain no grit or abrasives. They'll actually improve the ink taking qualities of your drafting surface.

For this purpose, K&E supplies cleaning particles put up in three different ways. We think the new plastic squeeze-bottle (3036C) is the handiest of all. The shaker-top can (3036) has also been a drafting-room favorite for some time. And, for double-duty cleaning, we suggest the ABC Dry-Clean Pad™ (3037), which holds slightly coarser granules that sift through soft mesh. The ABC Pad also comes in handy for wiping a complete tracing after it is finished, or for preparing certain surfaces for ink work. Or for an overall pre-cleaning, since the best way to insure clean tracings is never to let soil build up.

The proverbial ounce of prevention is worth the traditional pound of cure!

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2002

# DECEASED

**John B. Archer** (M. '57), age 66, highway engineer with the Capitol Engineering Corporation, died recently while on assignment in Saigon, Indo-China. The major part of Mr. Archer's career was spent in the employ of the West Virginia State Road Commission, as inspector in the Construction Department, Charleston; superintendent of the Project and Planning Department in Elkins; maintenance engineer and district engineer with headquarters in Charleston. From 1944 to 1951 he was with the U. S. Army Engineer Construction Group as a civilian employee in Hawaii and Japan, planning, supervising and coordinating field and office work.

**Pendleton Beall, Sr.** (M. '25), age 72, died on May 18 in Albuquerque, N. Mex., where he had lived since retiring ten years ago. At the time of his retirement he was superintendent of the Casper Wyoming Refinery of Texaco, Inc. Mr. Beall was a 1908 graduate of Rensselaer Polytechnic Institute.

**Scott Burkhardt** (A.M. '46), age 49, of St. Helens, Ore., died recently. He was a graduate of Oregon State College and the University of Illinois. A specialist in the design and supervision of airports and the uses of concrete, Mr. Burkhardt's professional career was spent with the U. S. Bureau of Reclamation in Denver, Ash-Howard-Needles & Tammen in Kansas City, and more recently Roberts & Schaefer in Chicago.

**John L. Costello** (M. '46), age 72, retired president of the Philadelphia Civil Service Commission, died in Philadelphia, Pa., on May 25. In 1952 Mr. Costello retired as president after previously serving as city examiner with the Commission for twenty years. He had been on the faculty of the University of Pennsylvania, his alma mater, and had served as president of the Philadelphia Chapter of the Pennsylvania Society of Professional Engineers.

**Philip Henry Falter** (A.M. '06), age 84, since 1936 president and director of the Massena Banking and Trust Company, Massena, N. Y., died recently in Leesburg, Fla. A graduate of the University of Michigan, Mr. Falter was with the Michigan Lake Superior Power Company at Sault Ste. Marie (1898-1902) as assistant engineer in charge of forebay and power house sections. Later he was general manager of the Shawinigan Electro Products Company, Baltimore; vice-president and general manager of the Canadian Electro Products Company, Montreal; and vice-president and treasurer of the Electric Furnace Company, Philadelphia. From 1925 to 1931 he had a consulting engineering practice in New York City, retiring from active practice in the latter year.

**John Giese** (M. '43), age 52, partner in the Harrisburg (Pa.) firm of Modjeski and Masters and nationally-known bridge builder, died at Camp Hill, Pa., on May 31. A 1928 graduate of Harvard University with a bachelor of arts degree in engineering sciences, Mr. Giese joined Modjeski and Masters that year, becoming a full partner in 1947. Among the bridges whose construction he directed were the Huey P. Long Bridge over the Mississippi River at New Orleans; the Walt Whitman Bridge over the Delaware River at Philadelphia; and the Greater New Orleans Bridge over the Mississippi at New Orleans.

**E. D. Harshbarger** (A.M. '06), age 82, former chairman of the board of the Pitt Construction Company, died in Pittsburgh, Pa., on May 7. In 1906 Mr. Harshbarger and the late Clark L. Wilcox founded the Pitt Construction Company. The firm built irrigation systems and water purification plants throughout the United States and had recently finished a water purification plant at Miami, Fla. Mr. Harshbarger attended Ohio State University and was a civil engineering graduate of Cornell University in 1901.

**W. T. Huber** (M. '20), age 76, president and treasurer of the Huber-Lanctot Housewrecking Corporation, died in Buffalo, N. Y., on May 16. Prior to forming Huber-Lanctot, which in addition to housewrecking activities was a supplier of building materials, Mr. Huber was associated with the Lackawanna Steel Company, the Buffalo & Susquehanna Railway, Pennsylvania Railroad, New York State Highway Department, State Barge Canal and the Portland Cement Association. He was a 1908 graduate of the Cornell University School of Civil Engineering.

**Henri Aime Hupner** (M. '53), age 68, civil engineer of Paris, France, died in France recently. Since 1913 he had been employed as an engineer of the French Government in the Administration of Bridges and Roads engaged on projects in the east of France and in Normandy and on construction of large bridges in the Garonne Valley. In his capacities as Ministre de l'Industrie et de l'Energie and directoire du Gaz et de l'Electricite he inaugurated studies on large dams and supervised their construction.

**Charles Wells Linsley** (M. '21), age 75, city engineer of Oswego, N. Y., died there recently. Mr. Linsley's professional life was spent in Oswego, for many years as general manager and, secretary-treasurer and plant engineer with the Oswego Candy Works, Inc. He had been city engineer for the past twenty-six years.

**Wayne W. McWhorter** (M. '58), age 47, manager of field erection for the

*(Continued on page 92)*

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Roebling's long interest and experience in suspended roofs and suspension systems of *all* kinds, puts us in the unique position of being able to work with you on any project involving these principles. We invite your inquiries on any phase or factor of suspended roofs. The data, applications and *experience* that we have accumulated will be shared with you to the fullest extent. Write Bridge Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

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# THE IROQUOIS DAM...

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*Photo courtesy of Power Authority of the State of New York*

Thousands of feet of drilling and sampling were performed for the initial planning of the Iroquois Dam (St. Lawrence Seaway). The accurate soil samples and high quality rock cores recovered contributed materially to the design of a suitable and firm foundation.

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## Deceased

*(Continued from page 90)*

Graver Tank and Manufacturing Company, Inc., of East Chicago, Ind., was killed in a recent airplane crash. Since joining the Graver Tank and Manufacturing Company in 1954, Mr. McWhorter had handled all the firm's labor relations, in addition to coordinating field erection with sales, estimating, engineering and manufacturing. Earlier he was erecting engineer and construction manager for the Koppers Company, Inc., and for twelve years was in charge of its large field construction projects.

**Albert A. Northrup** (M. '12), age 81, of Lexington, Mass., died on May 15. Mr. Northrop retired several years ago after many years with the Stone and Webster Engineering Corporation as a specialist on water and sewage works in inland towns. Communities thus served included Montevideo, Uruguay. For a time he was in partnership with the late George T. Seabury, for a number of years Secretary of ASCE, in the New York City consulting firm of Seabury & Northrop. Mr. Northrop was a graduate of New York University.

**James Lindsay Paton** (M. '57), age 49, senior designer assigned to estimates and specifications in the Baltimore engineering firm of Whitman, Requardt and Associates, died at his home in Glen Burnie, Md., on March 29. Mr. Paton joined the firm in 1947, after a six-year stint with the Corps of Engineers investigating German engineering operations on construction projects in the European Theater of Operations. While with Whitman, Requardt and Associates, Mr. Paton also served intermittently as an analyst on military and engineering matters on the Engineer Board of the Corps of Engineers and held a confidential security position with the government. He received his B. S. in civil engineering from Rose Polytechnic Institute in 1933.

**Monroe A. Steiner** (M. '20), age 76, retired engineer of Hays, Kans., died there on April 24. A graduate of the engineering school of the University of Kansas, Mr. Stainer was one of Hays' most distinguished citizens. Prior to his retirement in 1946 he had been assistant chief engineer of the Colorado and Southern Railroad, of the Fort Worth and Denver Railroad, and the Wichita Valley Railroad and chief engineer of the Denver Terminal Railroad. He had also been a consulting and construction engineer in the Kansas City, Mo., area and in various parts of the South.

**James Hammond Stone** (A.M. '12), age 77, who was chief of the Specifications and Plans Section in the Division of Design, Bureau of Public Roads, Washington, D. C., from 1923 until his retirement in 1953, died recently at Bethesda, Md. Following his graduation from Dartmouth College in 1905 and the Thayer

*(Continued on page 98)*

no.8
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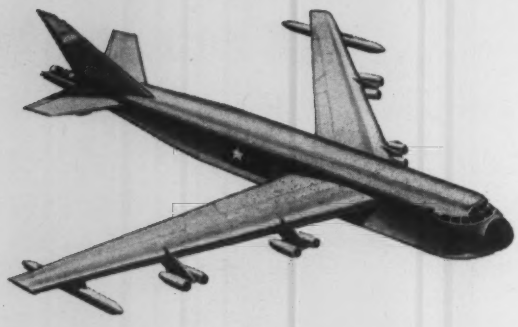

## At Kinross Air Force Base...

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THE "JET AGE" IS HERE. And with it is the problem of rebuilding airports to provide the longer, stronger, heavier runways these big jets need. That's why airport builders and designers are planning thicker, stronger airfield pavements with extra-heavy reinforcement . . . pavements that will match or exceed present jet requirements. And that's why the heaviest welded wire fabric ever produced was installed at the vital Kinross Air Force Base in Michigan.

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- USS American Welded Wire Fabric distributes heavy wheel loadings over a larger area to prevent harmful overloads at any one point. Impact, shock, suddenly applied or released loads such as occur during landings and take-offs are more uniformly "absorbed" by each slab. Reinforced concrete slabs are 30% stronger than unreinforced slabs of equal thickness.
- USS American Welded Wire Fabric prevents harmful cracking from developing because of its uniformly spaced high-tensile-strength welded steel wire construction. Its action "knits" a slab together.
- USS American Welded Wire Fabric unifies the action of any slab when it expands and contracts due to temperature change.
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Paving Material Supplier: Scioto Supply Company, Lansing, Michigan
Design and Supervision: Corps of Engineers, U. S. Army

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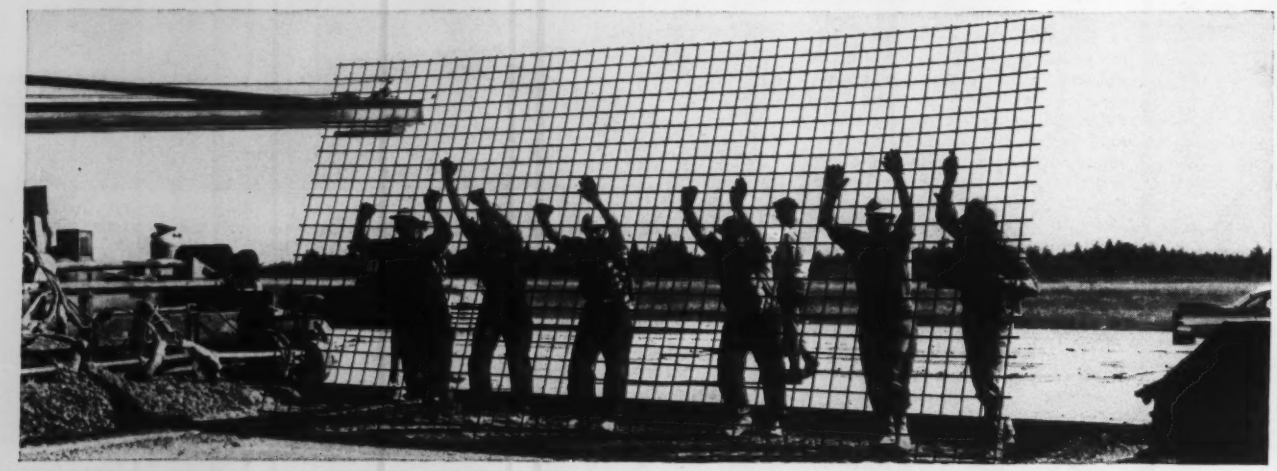
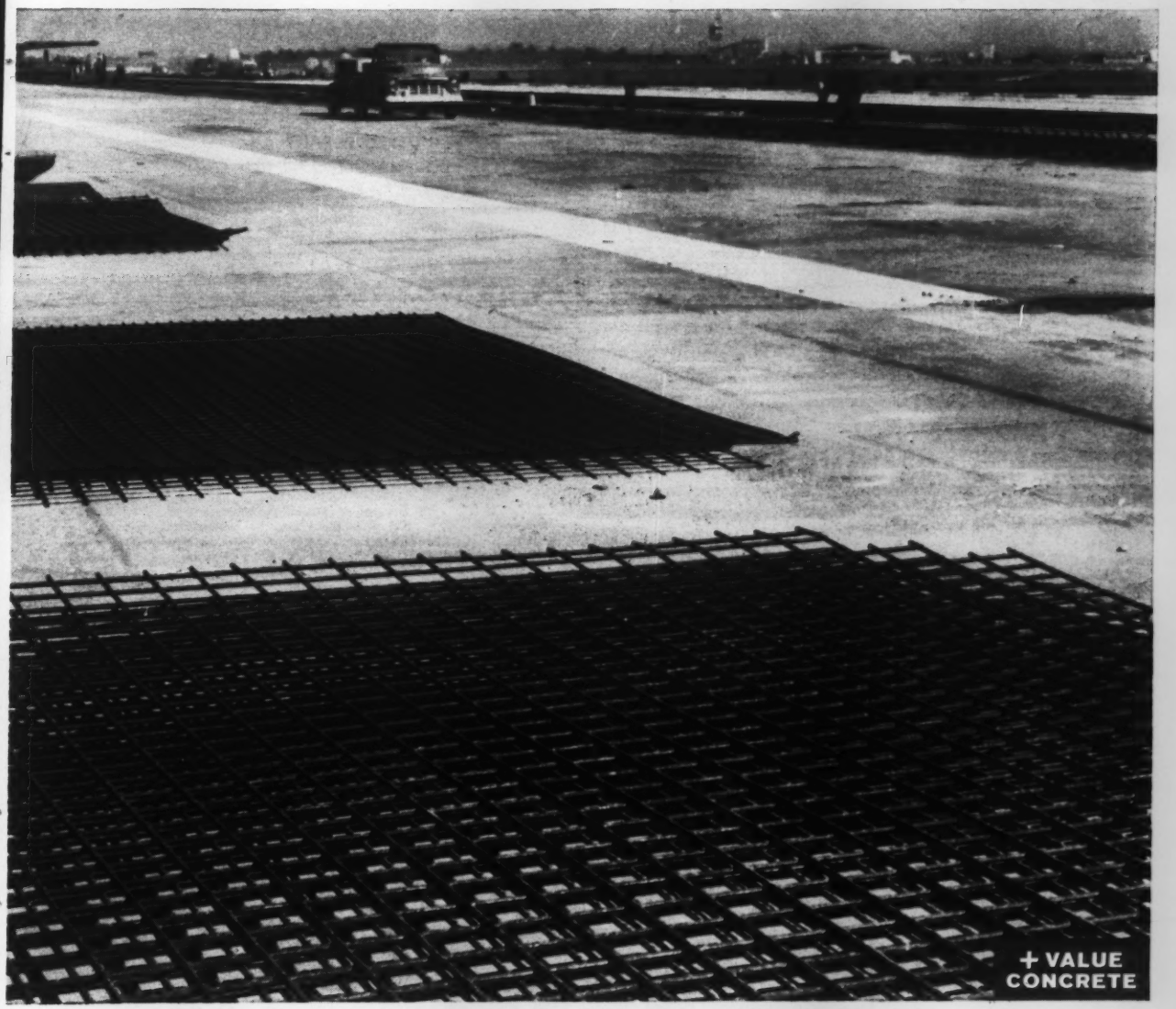


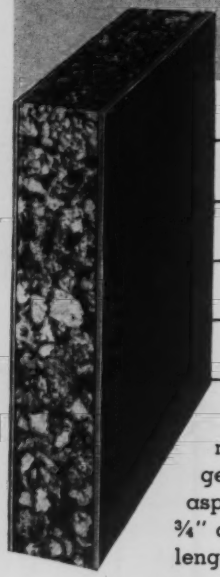
# World's heaviest Welded Wire Fabric big jets land safely!




Under the direction of the U. S. Corps of Engineers, another new United States Air Force Base is made ready to join our air defense network. It is Kinross, located on the Upper Peninsula of Michigan. This base was expanded to handle bigger, heavier modern jet aircraft. USS American Welded Wire Fabric was used in the rigid overlays on the strengthened and lengthened runways.

USS American Welded Wire Fabric

# 5 reasons for specifying AND USING SERVICISED® KORK-PAK premolded joint filler



1. Non-extruding
2. Recovers more than 80% of original thickness after compression
3. Low moisture absorption
4. Readily handled without breakage
5. Least expensive non-extruding type

KORK-PAK—an exclusive Servicised development—is composed of cork granules bonded together with asphalt between two sheets of heavy asphalt saturated paper. Available in ¼", ⅜", ½", ¾" and 1" thicknesses, widths to 36", and standard lengths of 5 or 10 feet. Longer lengths supplied on special order.

## TYPICAL APPLICATIONS

CONCRETE HIGHWAY CONSTRUCTION

KORK-PAK is widely used in concrete highway expansion joints because of its resiliency, non-extruding and low moisture absorption qualities.

AIRFIELD, AIRPORT PAVEMENT JOINTS

Airport and airfield concrete paving expansion joints filled with KORK-PAK and sealed with Zero-Lastic JF, require little or no maintenance.

INDUSTRIAL CONCRETE FLOORING

KORK-PAK is ideal for use on concrete flooring joints and building construction because of its high compressibility without extrusion factor, and its insulating value.

SERVICISED PRODUCTS CORPORATION
6051 WEST 65th STREET • CHICAGO 38, ILLINOIS


## New Publications

**Blasting log** . . . . Publication of the first uniform record book for blasting operators in construction is announced by the Associated General Contractors of America. Combining all data on blasting operations in one handy form, the "Blasting Log" assures contractors a permanent record of each blasting operation in the event of claims resulting from blasts. Copies are available from the Associated General Contractors, 1537 E. Street, N.W., Washington 6, D. C., at 20 cents each. For a dozen copies the price is $2.25, and for 100 copies, $15.

**Research and development** . . . . As the final part of its survey of the overall United States research and development effort during 1953-1954, the National Science Foundation has just released the report of the colleges and universities. Copies of the 175-page report are available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. The price is $1.00.

**Concrete practice** . . . . Issuance of two Manuals of Recommended Practice is announced by the Concrete Industry Board. One is concerned with "Inspection and Testing of Concrete Materials and Concrete," and the other with "Cast in Place Exposed Architectural Concrete Finishes." Inquiries should be addressed to the Concrete Industry Board, 220 East 42nd Street, New York 17, N. Y.

**Soil stabilization** . . . . The use of foamed asphalt in soil stabilization and for slurry seal coats is discussed in a new technical bulletin released by the American Road Builders Association. Written by Prof. Ladis H. Csanyi, M. ASCE of Iowa State College, the bulletin describes the development and testing of the process at Iowa State. Listed as Technical Bulletin No. 240, the publication may be ordered from the American Road Builders Association, World Center Building, Washington 6, D. C. Copies are 50 cents apiece.

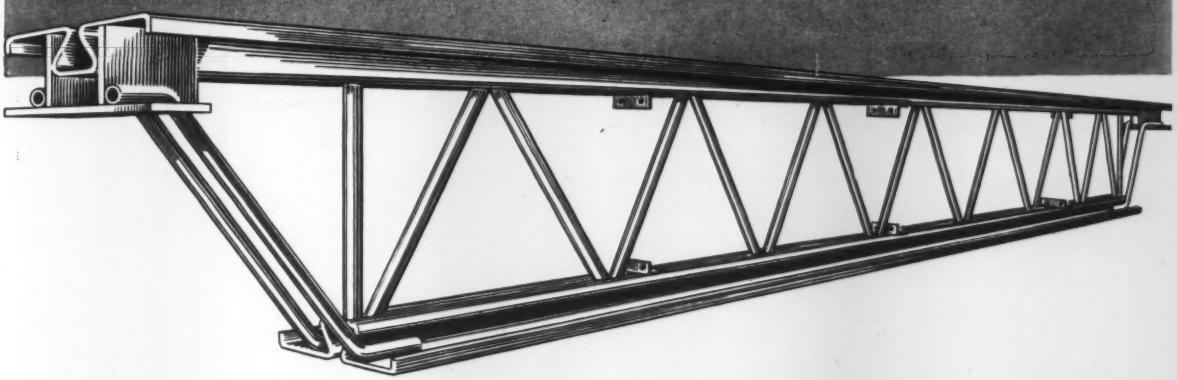
**Standards research** . . . . The increasing demands on the National Bureau of Standards made by the space age are detailed in the Bureau's Annual Report for 1958. The 138-page report describes a wide range of scientific studies, laboratory experiments, instrument developments, and technical publications. Identified as National Bureau of Standards Miscellaneous Publication 226, the report may be ordered from the U. S. Government Printing Office, Washington 25, D. C. It is 45 cents.

**Roof construction** . . . . The Wood Research Laboratory at Virginia Polytechnic Institute has just published a 24-page bulletin (No. 36) on "King-Post Nailed Trussed Rafters." The result of almost two years of research, the detailed report describes "what is believed to be the most economical roof construction developed to date." Prof. E. George Stern, M. ASCE, head of the Wood Research Laboratory, is the author. Inquiries should be directed to the Wood Research Laboratory, Virginia Polytechnic Institute, Blacksburg, Va.

**Parking problems** . . . . To aid traffic engineers, designers of parking garages, and others faced with the problem of finding space for today's outsized cars, the Automobile Manufacturers Association annually issues a compilation of vehicle dimensions. The current release, entitled "Parking Dimensions for 1959 Cars," is available from the Automobile Manufacturers Association, 320 New Center Building, Detroit 2, Mich.

**Prestressed bridge beams** . . . . Design data applicable to standard prestressed concrete bridge beams have been recommended by the Joint Committee of the American Association of State Highway Officials' Committee on Bridges and Structures and the Prestressed Concrete Institute. Prestress force and required 28-day ultimate concrete strength have been tabulated for approximately 16,000 composite bridge sections, including all of the H and H-S highway loadings. K. K. Kienow, J. M. ASCE, of the University of Arizona Civil Engineering Department, is author of the report, identified as Civil Engineering Series No. 3. Copies, priced at $1.00 each, may be obtained from the Engineering Experiment Station, University of Arizona, Tucson, Ariz.

# MACOMBER ALLSPANS



## The Engineering Milestone of Open Web Structural Members!

Macomber ALLSPANS, the economical high-strength open web floor and roof framing member, cover the entire range of sizes through 120 feet. Utilizing high-strength, cold roll-formed V-Section chords to provide maximum lateral rigidity and reserve strength, ALLSPANS now bring new standards of quality, performance and design efficiency to America's architects and engineers.

*FOR COMPLETE INFORMATION ON HOW YOU CAN PROFIT FROM ALLSPANS EXCLUSIVE FEATURES...* ***SEND FOR MANUAL***

**MACOMBER**

**CANTON 1, OHIO**

## Deceased

*(Continued from page 92)*

School of Engineering in 1909, Mr. Stone was employed in various engineering capacities in Maine, New Hampshire, and Kentucky. He began his career with the Bureau of Public Roads in 1917 at Denver, Colo.

**Victor B. Sudriers** (M. '46), age 85, director de Estudios Hidroelectrics, Montevideo, Uruguay, died there recently. Mr. Sudriers became director in 1938, the same year he was chosen to serve on the Executive Committee, constructing a 120,000-kw hydro power plant on the Rio Negro, Uruguay. He had been contractor on the construction of the Solis Bridge, a reinforced concrete trestle; the Pantanoso Bridge, a steel swing structure; and the Picado de Varelav Bridge, a reinforced concrete span.

**Earl C. Sutherland** (M. '46), age 61, senior highway engineer and authority on concrete paving with the Bureau of Public Roads, Washington, D. C., died there on April 20. As a research engineer with the Bureau since 1927, Mr. Sutherland had devoted most of his career accumulating data for making concrete last longer on the nation's highways. He was the author of a five-part report "On Structural Design of Concrete Pavements," which has been circulated throughout the world. He had 17 other published reports to his credit. For his extensive work in testing the effect of truck traffic on highways he was co-winner of the Highway Research Board Award in 1954. He was a graduate of Utah State University and received his civil engineering degree from George Washington University in 1930.

**Hale Sutherland** (M. '25), age 74, professor emeritus of civil engineering at Lehigh University, died in Media, Pa., recently. He retired from the Lehigh faculty in 1953 after a forty-year teaching career—twenty-three at Lehigh and seventeen at Massachusetts Institute of Technology. Professor Sutherland had an unusual interest in the cultural side of engineering education, and was influential in establishing humanistic social courses in the engineering curricula of college and universities of the nation. Professor Sutherland, who received his bachelor's degree from Harvard College in 1906 and his civil engineering degree from MIT in 1919, was co-author of two textbooks, "Structural Theory and Design" with H. L. Bowman and "Reinforced Concrete Design" with W. W. Clifford.

**Jamison Vawter** (M. '26), age 70, professor emeritus of civil engineering at the University of Illinois, Urbana, Ill., died at Champaign on May 23. Professor Vawter received his B. S. in civil engineering from the University of Kansas, where he was assistant professor of mechanics from 1920 to 1922, and his master's in civil engineering from the University of Illinois in 1934. From 1922 to 1937 he was assistant professor and associate professor of civil engineering at the University of Illinois and from 1937 until his retirement in 1957 he was professor. In the latter year, he joined the Urbana firm of Clark, Daily & Dietz as an associate.

**Richard Ward** (M. '38), age 71, engineer in charge of the enlargement of Lake Mathews for the Metropolitan Water District, died in Arlington, Calif., on April 27. He was one of the country's foremost water supply dam builders, and at the time of his death was directing work to increase the storage capacity on the terminal reservoir of the Colorado River Aqueduct, a $200 million expansion program. Mr. Ward graduated from the University of Kansas in 1913, and for the next eighteen years worked on a number of engineering projects including the construction of a government railroad in Alaska, U. S. Bureau of Reclamation irrigation projects in Montana and Wyoming, and the construction of a number of earthfill dams. From 1931 to 1938 he was with the Metropolitan District on the construction of the Colorado River Aqueduct and was resident engineer on the construction of the dam, dike, and appurtenant works for the Cajalco Reservoir (now Lake Mathews). He had also been engineer adviser to the Snowy Mountains Hydro-Electric Authority in New South Wales, Australia.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Architects, designers, and engineers seeking tools to give full application of their creative ideas in structural design and appearance will find that **concrete with living strength** from prestressing by the Prescon System of post-tensioning will greatly increase their architectural control over shape, span and load limits.

Breaking through the old design barriers imposed by conventional materials, today's architect or engineer who specifies the Prescon System of prestressed concrete can design for immediate building structures that will meet every future requirement of eye appeal and useful efficiency.

Give free range to your creative ideas, call your Prescon representative for specialized engineering and recommendations on using Prescon System in prestressed concrete for the long span beams and girders, lightweight decking members, poured in place floors and roofs and other exciting features of "breakthru design." Write for technical brochure, or check Sweet's Catalog.

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ATLANTA — P. O. Box 1175, DRake 7-3853, North Decatur, Ga.

CHICAGO — Crest Concrete Systems, Inc., P. O. Box 38, Bishop 2-1479, Lemont, Ill.

DENVER — 1445 West Quincy, SUnset 1-4798, Englewood, Colo.

LOS ANGELES — P. O. Box 407, FAculty 1-3377, Gardena, Calif.

NEW YORK — P. O. Box 9008 (Albany, N. Y.), DElmar 9-1676, Delmar, N. Y.

*MEMBER PRESTRESSED CONCRETE INSTITUTE*

# PRESTRESSED CONCRETE BEAMS for U.S. Route 1 Bypass . . .

Cranes lower prestressed concrete beam 95′ long, 4′ square, and weighing 58 tons, onto piers of one of the middle spans of the 4-span Ridley Creek Bridge. There are 16 beams per span. Note "railway" across creek at bottom of picture, used to trolley one end of beam across creek to crane at right.

• Ridley Creek Bridge, pictured here, is one of seven bridges required in the 8 mile long bypass around Media, Pa. Over 400 prestressed box beams, ranging in length from 40′ to 95′, were used in these structures.

Factors influencing the choice of this modern bridge construction technique were low initial and maintenance costs, ease and speed of erection, and the trim appearance of prestressed concrete.

In manufacturing the prestressed beams for these bridges, Atlantic Prestressed Concrete Company used Lehigh Early Strength Cement for maximum production efficiency. Units were completed quickly, ready for trucking to the job site as needed.

This is another example of the advantages of Lehigh Early Strength Cement in modern concrete construction.

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Glasgow, Inc.
Glenside, Pa.

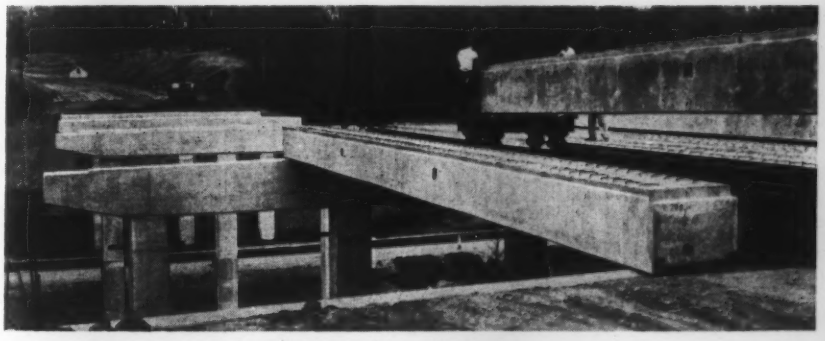
*Contractor for Construction of Bridges:*
McClain Construction Co., Inc.
Philadelphia, Pa.

*Manufacturer of Prestressed Beams:*
New Castle, Del. Plant,
Atlantic Prestressed Concrete Co.
Trenton, N. J. (wholly-owned Subsidiary of Warner Co., Philadelphia, Pa.)

*Ready Mixed Concrete for Beams Supplied By:*
Warner Company
Philadelphia, Pa.

## LEHIGH PORTLAND CEMENT COMPANY

**Allentown, Pa.**



Placing one of shorter beams for end span at Ridley Creek. Mobile crane (out of picture to right) is moving beam on rail dolly out to meet crane stationed on creek bed below. The two cranes then move beam to final position.

## Applications for Admission to ASCE, May 2-May 30, 1959

### Applying for Member

MANZUR AHMAD, Washington, D. C.
RALPH GERO BERK, Chicago, Ill.
JOHN FRIDOLIN BRAUN, Montreal, Que., Canada
FRANK WOOD BROMLEY, Phoenix, Ariz.
ROBERT DUNCAN BROWN, JR., Balboa Heights, Canal Zone
GEORGE THOMAS BUCHMEIER, San Francisco, Calif.
E. GEORGE CASSIS, Hillsboro, Ill.
ARVE HUBERT DAHL, Washington, D. C.
JOHN BRINDSON DOTTERER, New York, N. Y.
CONSTANTIN GEORGE FAKAS, New York, N. Y.
JOHN JOSEPH FIALA, New York, N. Y.
SYLVAN DAVID GINSBERG, Chicago, Ill.
EDGAR ALLEN GRISWOLD, San Marino, Calif.
WILLIAM BEDARD HAAS, Omaha, Nebr.
TETSUO HARANO, Honolulu, Hawaii
HARRY LESLIE EDIS HOLLAND, New York, N. Y.
MULBAGAL MOHIYADDEEN HUSAIN, Fort Wayne, Ind.
KEITH F. JONES, Tacoma, Wash.
RANDOLPH BURDETTE LARGE, SR., Syracuse, N. Y.
WILLIAM RUDOLPH LORMAN, Port Hueneme, Calif.
DAVID SMITH PEDEN, Bowling Green, Ky.
FRANK BENTON SARLES, Santa Rosa, Calif.
ROBERT JOHN SAUSE, Youngstown, Ohio
YAN CHANG SHIU, Cincinnati, Ohio
GEORGE EDWARD SHIEFTER, Athens, Ohio
ERNEST ALFRED SLADE, Tulsa, Okla.
ISRAEL H. STEINBERG, San Francisco, Calif.
CLIFFORD ADAM STUMM, Williamsville, N. Y.
JOHN JAMES TIBBITS, Cleveland, Ohio
FORREST ALWYN TOWNER, Kansas City, Mo.
FERNANDO VASCO COSTA, Lisbon, Portugal
WILLIAM WALLACE, JR., Peru, South America
DEAN EDWIN ZUMWALT, Peoria, Ill.

### Applying for Associate Member

HAROLD FAHY BAKER, Hampton, Va.
CLYDE EMERSON BASTIAN, JR., New Orleans, La.
ROSS PARKINSON BROWN, Cheyenne, Wyo.
JAMES HERSEY BUMSTEAD, Riverside, Calif.
FOREST WARWICK CLARK, Niles, Ohio
ROBERT COOPER, New York, N. Y.
EDMUNDO HERNANDEZ CAPISTRANO, Manila, Philippines
JAMES ROBERT MONCRIEFF CARR, Valletta, Malta
EARNEST CARL DRIVER, Coral Gables, Fla.
ROY ARTHUR DAVIS, JR., Austin, Tex.
NWOYE BINYELUM DIBIAEZUE, Nigeria, West Africa
PASQUALE FAZIO, New York, N. Y.
WALTER RONALD FERRIS, Cambridge, Mass.
WILLIAM THOMAS HELM, Hyattsville, Md.
LAWRENCE JOSEPH HRUZA, St. Paul, Minn.
MILTON HUDIS, Santa Rosa, Calif.
JOSEPH NORMAN HUTCHESON, Florence, Ala.
THOMAS JOSEPH IRZA, Topeka, Kans.
ROSCOE CONKIN JENNINGS, JR., Cleveland, Ohio
BORIS SERGEEVICH KALINOVSKY, San Francisco, Calif.
RAYMOND DAVID LEVITH, Pittsburgh, Pa.
DONALD ARNOLD MCCLURE, New York, N. Y.
WILLIAM BLAIR MCLACHLAN, Los Angeles, Calif.
GEORGE HERNDON MENGEL, El Paso, Tex.
RAYIRATH GOVINDA MENON, Kerala State, India
GHULAM MOHAMED NARWARO, Roorkee, India
RAYMOND RIEN OSENGA, Santa Rosa, Calif.
EUGENE EDWARD PEER, Arlington, Va.
KENNETH AUSTIN PHILLIPS, Cheshire, England
JULIAN O. PILCHER, Baton Rouge, La.
JAMES ANTHONY RYAN, Seattle, Wash.
CYRIL JOHN SAUSER, Albuquerque, N. Mex.
JAMES WILLIAM SKEHAN, Weston, Mass.
NILS OLAI SKORVE, Lakeland, Fla.
THOMAS YEADON STURTEVANT, Reno, Nev.
JOSEPH DANIEL WALTERS, Sacramento, Calif.
SANGER KNEELAND WESTPHAL, Joliet, Ill.
MERLON ELMER WIGGIN, Presque Isle, Me.
WILLIAM WISSE, Columbus, Ohio
L. D. WITTIE, Wichita Falls, Tex.
JOHN DELVES WOODWARD, Jamaica, N. Y.

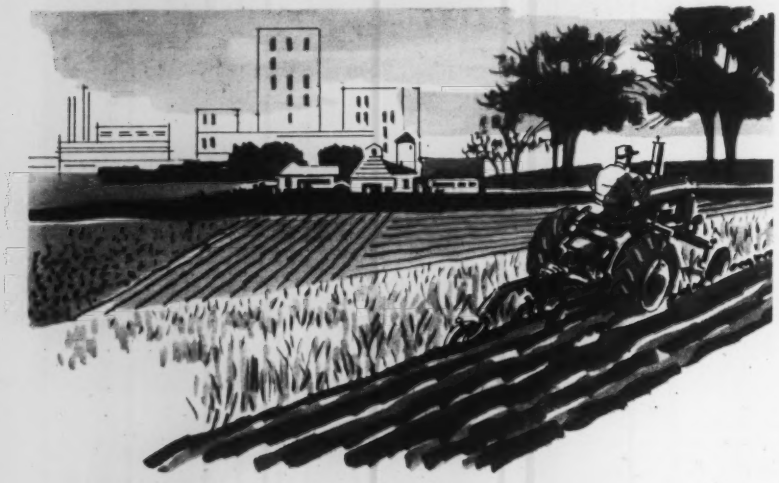
### Applying for Affiliate

DAVID LAPIDUS, Sepulveda, Calif.

### Applying for Junior Member

JAYANTILAL H. BARIYA, Cincinnati, Ohio
BARRY JAMES BRADBURY, Lancashire, England
PETER HERNY COOK, Wayne, Mich.
HECTOR JOSEPH DIAZ, Tampa, Fla.
JOHN ROLLAND EATON, Sacramento, Calif.
CARL WARBURTON GEORGE, JR., San Angelo, Tex.
RICHARD LEE HENRY, Rolla, Mo.
LAWRENCE LEE ICE, Miller, S. Dak.
ABRAHAM KAVKEWITZ, Sherman Oaks, Calif.
ROBERT JOSEPH KERRIGAN, Boston, Mass.
EDWARD KOMISARCIK, Gary, Ind.
LAWRENCE KRESHIN, Port Hueneme, Calif.
ROBERT JAMES LA BRIE, Altadena, Calif.
KENNETH HAROLD LEMKE, Toledo, Ohio
JOSEPH THOMAS MCCOLGAN, JR., New Haven, Conn.
RICHARD ALEXANDER NICHOLSON, Buffalo, N. Y.
DON ALEX PETRY, Ft. Wayne, Ind.
RICHARD DEAN RAY, Sparr, Fla.
JOHN ELBERT REMPERT, South Pasadena, Calif.
JEAN FREDERIC RIEL, Iowa City, Iowa
CHARLES ARTHUR STEVENSON, Toronto, Ontario, Canada
SUNTAT SUKDHISRI, Tucson, Ariz.
LAMBERT TALL, Bethlehem, Pa.

*[Applications for Junior Membership from ASCE Student Chapters are not listed.]*

# TREES AND WATER

Strange as it may seem, there are some disadvantages to civilization. Two of them are water pollution and ground water shortage.

The more people in a community, obviously the more serious the water pollution prospects become, due to both domestic and industrial waste materials. Also as populations grow, forest areas tend to decrease. Growing cities, new and bigger industries, more and larger farms mean less forested area and less trees, faster rainfall runoff and less ground water storage. Trees and underbrush are Nature's way of helping rainfall soak into the ground instead of running off into streams, rivers, and the sea.

Apparently Mother Nature and the Human Race need to make some adjustments in order to satisfy each other. Ground water shortage is one of the big problems facing the American water works industry, and emphasizes the fact that the job of water works superintendent is vitally important to the American way of life. Give your water works superintendent a hand—whenever you can.

*This Series is an attempt to put into words some appreciation of the water works men of the United States.*

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## RECENT BOOKS

*(added to the Engineering Societies Library)*

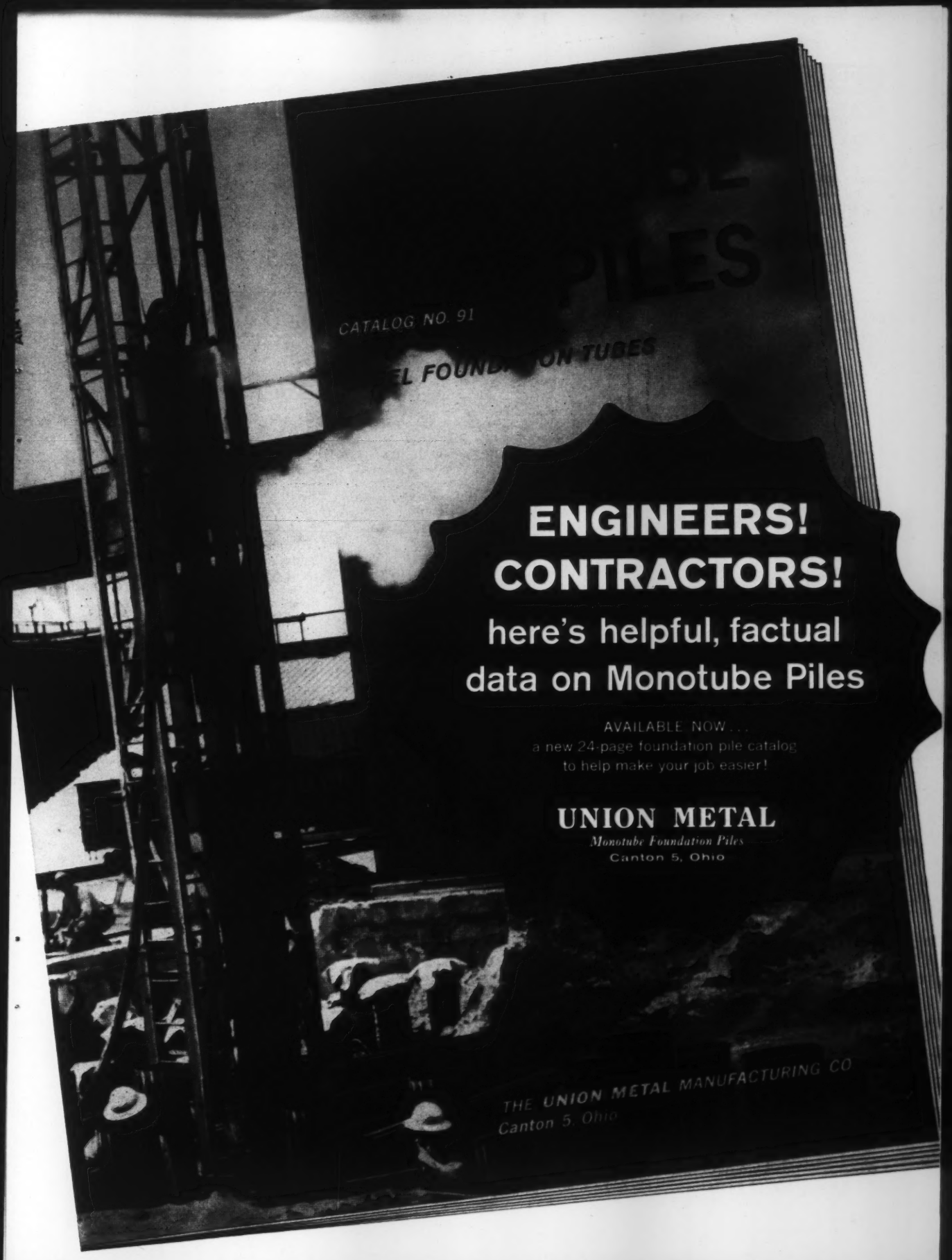
**An Introduction to the Theory of Structures**

A basic text which reviews such areas as statistics; beams; trussed frameworks; deflection of beams; fixed-end and continuous beams; stress and strain; stress distribution in the interior of members; the use of theory in design; earth pressures, retaining walls, and rivet groups; moving loads; pillars; slope deflection and moment distribution. A number of examples and their solutions are treated at length. (By W. Merchant and A. Bolton. St. Martin's Press, Inc., 175 Fifth Avenue, New York 10, N. Y., 1957. 210 pp., bound, $5.75.)

**Bewegungsfugen im Beton—UND Stahlbetonbau**
Sixth Edition

Dealing with expansion joints in concrete and

*(Continued on page 109)*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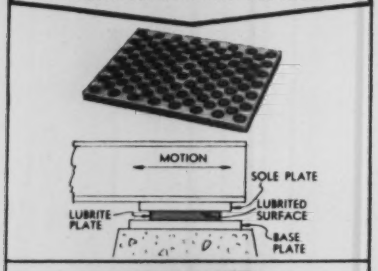
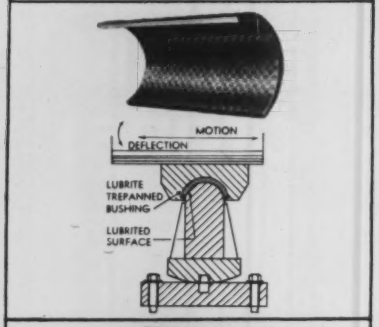
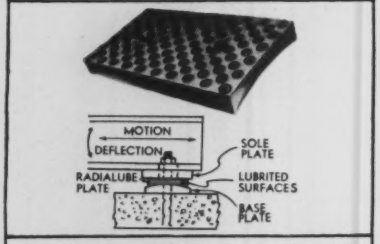
**EXPANSION PLATES & BUSHINGS**

3 BASIC LUBRITE ASSEMBLIES FROM MANY AVAILABLE

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## News of Members

*(Continued from page 25)*

**Floyd L. Reed** retired on May 1 as manager of the Cincinnati (Ohio) district of the American Bitumuls & Asphalt Company, a subsidiary of Standard Oil of California, after almost thirty years of service to the company.

**Daniel L. Scharff,** civil engineer, and civic and religous lay leader of New Orleans, La., has received the second annual Temple Sinai Brotherhood Man of the Year Award. Mr. Scharff was associated for many years with the investment firm of Scharff and Jones, Inc., as secretary-treasurer. He is being honored for his "many years of service to New Orleans." as well as for his contributions to brotherhood.

**Robert L. Brice** has been confirmed by the Iowa State Senate as a member of the Iowa State Highway Commission to June 30, 1961. Since July 1, 1957, Mr. Brice has served as highway commissioner on an interim appointment. In 1955, he established the consulting firm of Robert L. Brice & Associates at Waterloo, specializing in civil and structural engineering.

**Arvid R. Karkkainen,** deputy city engineer of Rochester, N. Y., was promoted on May 31 to city engineer. As city engineer, he will head the Department of Public Works Engineering Bureau, which has a staff of 124 and four major divisions —construction, design, research and survey. Mr. Karkkainen became an assistant engineer in 1955, associate the next year, and deputy last year.

**David Bulman,** a recent civil engineering graduate of the Clarkson College of Technology, has been awarded a fellowship in transportation at Yale University for the year beginning September 1959. Mr. Bulman for the past year has served as principal right-of-way engineer with the Rochester, N. Y., firm Robert E. Smith.

**Frederick S. Kent,** sanitary engineer director for the U. S. Public Health Service, Washington, D. C., has been transferred from his position as chief of the Interstate Carrier Program in the Division of Engineering Services, to the position of regional program director for engineering activities in the San Francisco Regional Office of the Public Health Service.

**W. V. Buck,** regional engineer for the Bureau of Public Roads at Kansas City, Mo., retired recently, after twenty-six years of continuous government service. On May 4 he assumed new duties as state highway engineer for South Dakota, at Pierre. During his years with the Bureau Mr. Buck served in the capacity of chief of the Design Section at Washington, D. C., and regional engineer, at St. Paul, Minn., and Kansas City, Mo.

## Positions Announced

**U.S. Civil Service Commission.** Vacancies exist for engineers interested in a career with the Bureau of Reclamation. Starting salaries are: GS-5, $4,490; GS-7, $5,430; and GS-9, $6,285 per annum. Candidates must have a degree in civil engineering or a professional engineer's license in the same or allied branch of engineering as the position for which he is applying or a combination of experience with acceptable college-level engineering education. In addition, a written examination is given for the advanced grades. Application forms are available from many post offices throughout the country or from the U.S. Civil Service Commission, Washington 25, D. C.

**United States Civil Service Commission.** A dozen or more City and Regional Planners are urgently needed for positions with the National Capital Planning Commission in the Washington, D. C., metropolitan area and throughout the United States. A few positions may also be filled in foreign countries. Starting salaries range from $5,985 to $12,770 a year. Applicant must be a citizen or at least owe allegiance to the United States, and must hold a bachelor's degree or the equivalent from an accredited university. Until further notice applications will be accepted by the U. S. Civil Service Commission, Washington 25, D. C. At the same time the Commission announces a new examination for filling career positions in Cartography in various Federal agencies in the Washington, D. C. area. The salary is from $4,040 to $12,770 a year and includes grades GS-5 through GS-15. The majority of the positions to be filled are in the Army Map Service, the Aeronautical Chart and Information Center, the Geological Survey, the Bureau of Management, the Coast and Geodetic Survey, and the Navy Hydrographic Office. Requirements are similar to those already listed. Send applications to the Executive Secretary, Board of United States Civil Service Examiners, Army Map Service, Washington 25, D. C.

**City of Duluth.** Vacancies exist for a qualified Civil Engineer IV; salary range from $557 to $666 per month, plus free health and life insurance, between 21 and 55 years old; Sanitary Engineer, salary range from $459 to $559, with an engineering degree and some course work in sanitary engineering subjects or equivalent experience, not over 55 years old. Duluth is expanding its municipal engineering program for a new Seaway port and offers opportunity for advancement. Application forms and full information may be obtained from the Civil Service Board, City Hall, Duluth 2, Minn.

**Agricultural and Mechanical College of Texas.** A Fellowship in Engineering, open to engineering graduate with broad interests, carries $3,000. Apply to Department of Oceanography and Meteorology, A & M College of Texas, College Station, Tex.

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*Johns-Manville brings you an entirely new concept of evaluating your community's needs . . .*

# NEW!

## 84-page book tells you how to get better water service for your community!

**Gives unique step-by-step method for water service evaluation and trouble-spotting.**

**Uses case histories to show how improved water service can benefit your community.**

**Tells how to make your community want—and approve—water system improvements.**

"PRICELESS WATER . . . it's your business" is written expressly for water utility managers, engineers, public officials—all those business and community leaders who are alert to the basic contribution good water makes to the life and economic well-being of a community.

The result of months of study, planning and research—"PRICELESS WATER" is edited in four sections:

***Section One,* "How good water service benefits your community,"** gives you needed "ammunition" to convince the most skeptical of the many advantages of good water service. It shows how improved water service affects property values and insurance rates. How an efficient water system will attract business. How a poor system turns it away! This section tells how entire communities have benefited by water improvements.

***Section Two,* "How to evaluate your water system,"** is edited for water and town planning officials. It is a new, step-by-step method for water service evaluation. It shows how you can quickly and easily evaluate the efficiency of everything from community water supply, treatment and distribution to metering, staff facilities and operations.

***Section Three,* "How to turn evaluation into improved water service,"** tells when a preliminary engineering survey is needed. When and how to retain a consulting engineer. How to use his report as a springboard for action. Fiscal agents, and when and how to use them. Also contains a helpful explanation of various financing methods.

***Section Four,* "Arousing the public to action,"** is an easy-to-follow, success-proven handbook on public relations. It tells how a soundly conceived PR program can sell your community on water service.

In short, "PRICELESS WATER" is the hard-hitting tool you need to get your community the improved water service it needs. Send the coupon for your free copy, now!

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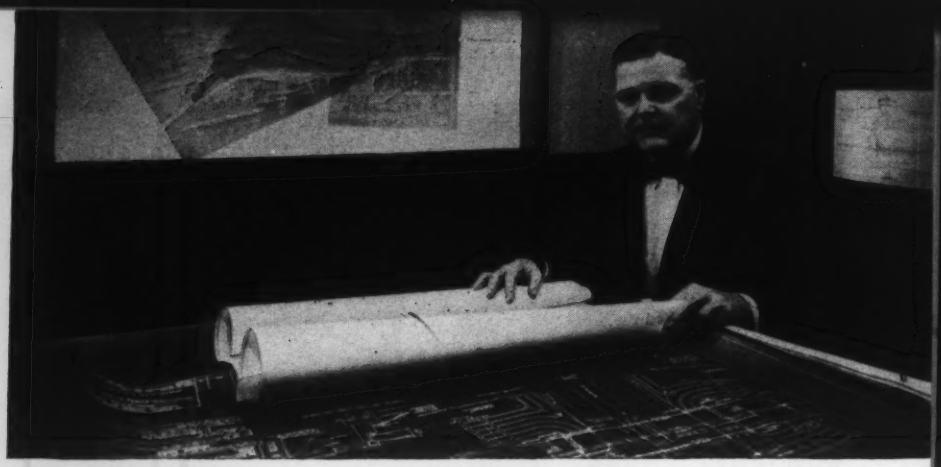

**Mr. Maurice N. Quade,** Senior Partner of Parsons, Brinckerhoff, Hall & Macdonald, designers of about 50 steel bridges a year.

**One of the handsome steel bridges** on the Prospect Avenue Expressway, Brooklyn, N.Y., designed by Parsons, Brinckerhoff Hall & Macdonald.

# Steel is a predominant structural material in short-span bridge work

at Parsons, Brinckerhoff, Hall and Macdonald, Consulting Engineers.

PARSONS, BRINCKERHOFF, HALL & MACDONALD will celebrate their 75th anniversary next year as consulting engineers in the civil engineering field. The scope of their work in the western hemisphere includes highways, bridges, tunnels, municipal and sanitary work, airports, river and harbor work, etc. In the highway field they designed between 50 and 60 short-span bridges in 1958, using rolled steel beams. Currently they have about 50 more on the boards.

Some of the projects include parts of the Bergen-Passiac Counties Interstate Expressway in New Jersey; the Prospect Avenue Expressway in Brooklyn, N.Y.; the Queen Elizabeth Way Connections in Hamilton, Ontario, Canada; the New York State Thruway; Northeast Expressway, Massachussets.

## Steel is an economical material

Mr. M. N. Quade, Senior Partner of the firm, says that the majority of short-span designs on their drawing boards are composite beam construction, utilizing concrete decks. Combining steel beams with concrete makes it possible to save construction costs. Steel construction goes up fast and saves time and labor. The factors of economy, quick erection and availability all contribute to the fact that steel is a predominant material used in short-span bridge projects.

**Increased facilities.** There is an ever-expanding demand for steel because of its many advantages in the fast-growing market for bridge construction. The steel industry has had the foresight to grow with this vigorous market through greatly expanded facilities for manufacture of structural shapes and plates. You can confidently design in steel—the material you know best, the material that offers most—knowing it will be available.

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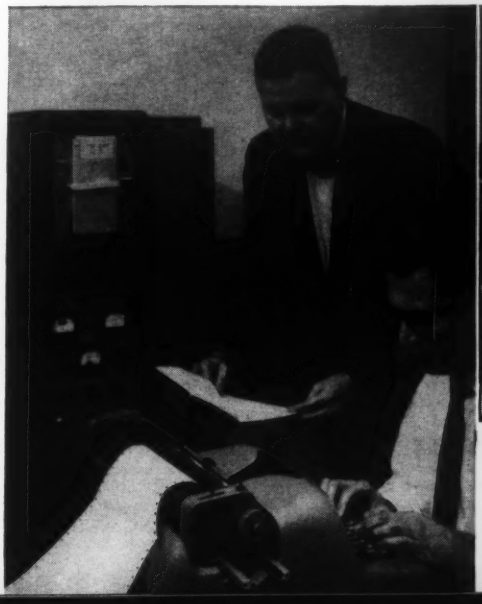

**Quick erection,** low cost, composite beam construction, reduction in traffic delays are a few reasons why structural steel is the predominant material for bridges.

**Mr. Quade** (left) shown with a new electronic computer system which his company uses to speed up engineering work in composite beam design and in figuring large projects.

# ENGINEERING SOCIETIES PERSONNEL SERVICE, INC.

**NEW YORK** 8 W. 40th ST. | **CHICAGO** 84 E. RANDOLPH ST. | **SAN FRANCISCO** 57 POST ST.

These items are listings of the Engineering Societies Personnel Service, Inc. This Service, which cooperates with the national societies of Civil, Electrical, Mechanical, Mining, Metallurgical and Petroleum Engineers, is available to all engineers, members or non-members, and is operated on a non-profit basis. If you are interested in any of these listings, and are not registered, you may apply by letter or resume and mail to the office nearest your place of residence, with the understanding that should you secure a position as a result of these listings you will pay the regular employment fee of 5 percent of the first year's salary if a non-member, or 4 percent if a member. Also, that you will agree to sign our placement fee agreement which will be mailed to you immediately, by our office, after receiving your application. In sending applications be sure to list the key and job number.

When making application for a position include 8 cents in stamps for forwarding application to the employer and for returning when possible.

A weekly bulletin of engineering positions open is available at a subscription rate of $3.50 per quarter or $12 per annum for members, $4.50 per quarter or $14 per annum for non-members, payable in advance.

## Men Available

PROFESSOR, M. ASCE, Masters's degree, age 36. Six years of teaching structural engineering, and ten years of industrial experience in bridge, building, and foundation design. Some recent publications. Desires teaching position. C-458.

STRUCTURAL ENGINEER, M. ASCE, B.S.C.E., age 34. Ten years' experience in structural design, organization and supervision of bridge design projects. Registered professional engineer. C-465.

OFFICE OR DESIGN ENGINEER, M. ASCE, B.S.C.E., 35. Five years' railroad divisional engineering; three and a half years' foreign railroad location and structural design (timber, concrete, and steel); and two and a half years' structural design (concrete and steel buildings, retaining walls, and dams). Speaks Portugese. C-466.

FIELD AND OFFICE ENGINEER, A.M. ASCE, B.C.E., age 29. Four years' as field and office engineer on variety of projects in Venezuela, such as refinery construction, pipelines steel tank erection, etc., and on Atomic Power Plant here in U.S. Location desired: Northeast U.S. C-467.

ADMINISTRATOR, A.M. ASCE, B.S.C.E., LL.B., age 33; seeks firm with complex domestic or foreign operations. Past five years' associate of 40-man consulting firm; directed architectural space planning; contract negotiation, sales, project planning, analytic reports. Also two years' steel design, highway construction; three years' export sales engineering materials. C-468.

CIVIL ENGINEER, A.M. ASCE, member of society of Turkish Civil Engineers, graduate of the engineering department of American College for Boys (Robert College) Istanbul, Turkey, single, age 29. One and a half years' experience in building construction as assistant field engineer, one year experience as responsible chief engineer in building construction, eight months as chief site engineer in drilled in pile foundations. Interested in getting a job as field engineer preferably in the U.S. Travelling expenses to U.S. or Europe to be covered by applicant. Speaks English, Turkish and Greek. Presently located in Turkey. C-469.

CIVIL ENGINEER, A.M. ASCE, B.S.C.E., age 28. Sanitary design engineer, two years'; municipal engineer, one and a half years; public health engineer, nine months'; engineer officer, U.S.M.C., 27 months'; graduate student in sanitary, hydraulic and municipal engineering, one and a half years. Location desired: Southeast, or West Coast. C-470.

ENGINEERING MANAGEMENT, M. ASCE, M.S.C.E., age 36. Registered structural, registered P.E. Fifteen years' experience heavy, municipal and housing construction: Bridge, general industrial and municipal design, desires move to Midwest, S.W. or West. C-959-Chicago.

ENGINEERING OR CONSTRUCTION MANAGER, A.M. ASCE, B.S.C.E., age. 35. Registered P.E. Indiana and Florida. Thirteen years' construction, design, estimating, bidding, contracts, supervising subcontractors. Several complete projects from design to finished product from completed plant. C-961-Chicago.

CIVIL ENGINEER, (Structural), A.M. ASCE, B.C.E., P.E., age 31. Four years' experience in designing, drafting and detailing; reinforced concrete and structural steel; two years' field inspection—construction. Location desired: New York, N. Y. C-471.

STRUCTURAL DESIGN-CONSTRUCTION, M. ASCE, C.E., age 48. Twelve years, structural design, oil refineries, process plants, marine installations, industrial plants, steel and concrete; engineering construction; one year field representative on atomic tests of structures for the government; five years' design, construction and maintenance, bridges, buildings, railroad; three and a half years design, construction bridges, pavements, sewers; municipal. $850 per mo. Prefer San Francisco, West. SF(M)-1869.

STRUCTURAL DESIGN-CONSULTANT, INDUSTRIAL, A.M. ASCE, M.S.CE., age 27. Two years' design prestressed, precast, concrete bridges; state and government; nine months' bridge design, soil analysis; consultant; three months' design, draft; ship conversion; three months' structural design; aircraft. $600 per mo. Prefer Oregon, Washington. SF(M)-1578.

STRUCTURAL, HYDRAULIC DESIGN—HYDRO, INDUSTRIAL, A.M. ASCE, C.E., licensed in California and New York, age 58. Twelve years as group supervisor, hydraulic and structural design, checking, field supervision; industrial buildings, hydraulic, engineers and constructors, consultants; nineteen years as field engineer, fruit company; assistant engineer, water supply, transportation, government. $800 per mo. Prefer San Francisco Bay Area. SF(M)-992.

STRUCTURAL DESIGN—HYDRAULIC, INDUSTRIAL, CHEMICAL, A.M. ASCE. C.E., age 34. Six and a half years' design, check, detail, construction, develop; water district, fabricating shop, chlorine plant, engineer-constructor, chemicals, consultant. Salary open. Any location. SF(M)-656.

DESIGN—CONSTRUCTION, PUBLIC WORKS, A.M. ASCE, CE, California CE License, age 33. Three and a half years as department head, construction plans, specifications, estimates on street, sewer, water systems, drainage, flood control; consultant; three years as director of public works, plan, design, maintenance; city; three years as junior civil engineer, public works; city. $10,000. Prefer Europe, Australia. SF(M)-512.

OFFICE, FIELD—HEAVY INDUSTRIAL CONSTRUCTION, AM. ASCE, CE, age 43. Eight and a half years' project, cost engineer; supervise office, field, contract liaison, progress payments, estimates, reports on heavy industrial construction; construction company. $800 per mo. Prefer San Francisco Peninsula. SF(M)-509.

ESTIMATE, DESIGN—CITY, GENERAL CONSTRUCTION, A.M. ASCE, CE, age 26. Two and a half years' engineer-estimator, estimates, takeoff quantities, coordinate subcontracts, purchase materials; general constructor; eight months assistant field superintendent, layout of utility lines, coordination of construction; construction company: ten months estimator, take-off quantities, pricing; plumbing, heating and ventilation. $550 per mo. Prefer San Francisco Peninsula. SF(M)-492.

DESIGN, ESTIMATES, SALES—PUBLIC WORKS, MANUFACTURING, CONSULTANT, A.M. ASCE, CE, California CE License, age 39. Three and a half years' assistant manager, estimate, contract negotiation, sales, supervision of office and field, erection steel, precast concrete, machinery, earthwork, design; cranes and rigging company. Two and a half years' associate civil engineer, flood control; government. One year design, draft concrete and rockfill dams, channels, quantity, cost estimates; power house, dams construction. Two years' instructor. U.S. Air Force. Two years' manager; irrigation district. $7,800. Prefer San Francisco Peninsula, California. SF(M)-488.

CONSTRUCTION ENGINEER, DESIGN—BRIDGES, PUBLIC WORKS, M. ASCE, M.S. C.E, California CE License, age 45. Associate bridge engineer for twenty-five years, supervisor construction, design, bridges, storm drains, facilities; government and six months draft, design on highway; architect-engineers. Salary open. Any location. SF(M)-446.

SENIOR PROJECT, CONSULTANT—WATER PROJECTS, M. ASCE, CE, California CE License (and 8 others), age 56. Vice president nine and a half years engaged in water development, consulting engineers, one and a half years in private practice, water development, and twenty-one years senior engineer, water supplies and use, civil works; government. $15,000. Prefer Northern California, West of Rockies. SF(M)-420.

VICE PRESIDENT, CHIEF ENGINEER—CONSTRUCTION, ARCHITECT, M. ASCE, Registered Architect, California, age 48. Vice president seven years with architect-engineer and heavy construction company; airports, harbors, dams, water and sewage, hydroelectric, commercial, industrial buildings; project manager and chief engineer for one year on construction of hydro dam and power plant, construction company; chief engineer nine and a half years on heavy engineering construction. 8 years owner, chief architect, chief engineer; architectural firm. $20,000. Prefer San Francisco, U.S. SF(M)-676.

DESIGNER-CONSTRUCTION, M. ASCE, MSCE, age 36. Seven years design supervisor, project engineer on roads, buildings marine structures, water supply, home sites, utilities; oil company; four years' bridge design, road and building construction for consulting engineers. $14,400. Prefer Midwest, Southwest, Foreign, West. SF(M)-411.

SALES, ESTIMATE, FIELD—CONSTRUCTION, A.M. ASCE, CE, age 32. Five and a half years' sales, estimate, contract, prepare shop drawings; construction specialties, industrial and commercial projects, three and a half years' field engineer, power plant construction; one and a half years' office engineer, write construction contracts, specifications and construction schedules; power plant construction. $600 per mo. Prefer Arizona. SF(M)-405.

DESIGN, SOILS, TEACH—FOUNDATION, CONSTRUCTION, A.M. ASCE, CE, age 31. Four years' design, layout, inspect construction of pump houses, reservoirs, docks, valve pits, retaining walls, roads, charge survey party and soils lab; water supply. Eight months engineering aide, new and modified airbase facilities. One year instrumentman; airbase construction. $700 per mo. Prefer Southern California, Foreign. SF(M)-386.

ASSISTANT FIELD ENGINEER—CONSTRUCTION, A.M. ASCE, CE, age 26. Three years' reports, contracts, budgets for construction and development of Navy facilities, USN (Completed). $6,300. Prefer San Francisco Bay Area, Pacific Coast. SF(M)-374.

MANAGER, DESIGN—IRRIGATION, HYDRAULICS, HIGHWAYS, M. ASCE, Licensed CE, Calif., age 52. Twenty-six years manager of operations, water and power, public works. $700 per mo. Prefer Southern California, West. SF(M)-289.

## Positions Available

SUPERINTENDENT to manage shop for structural steel fabricator and vessel builder. Must know metal fabricating, machining and all kinds of welding processes. Engineering graduate preferred. Requires energetic person with leadership ability and cost consciousness. 150 shopmen. Salary open. Location, East. W-7092.

ASSISTANT PROFESSOR of civil engineering, to teach fluid mechanics; M.S. in civil engineering required. Apply by letter giving personal record and minimum acceptable for nine months salary. Location, Midwest. W-7348.

JUNIOR SANITARY ENGINEER with some experience in construction; several years of work experience required. Company will provide some training in the phases of work as municipal consultants specializing in hydraulic and sanitary design and construction. Location, upstate New York. W-7376.

FACILITIES ENGINEER, degree in either civil, mechanical or business engineering; Master's degree in business administration desirable. Must have a broad background in business operations and finances. Will work in department whose function is to study, evaluate, make economic comparisons of various alternate approaches, determine final costs within close limits and finally recommend to top management the course of action for the company's short and long range manufacturing expansion program. Salary open. Company will pay moving expenses. Location, upstate New York. W-7393(a).

DESIGNERS for structural engineering department of a firm of architects-engineers; junior, senior

designers and design draftsmen and draftsmen. Salaries open. Location, South. W-7407.

CONSTRUCTION ENGINEER, with a thorough knowledge of estimating, expediting and office practice in the fields of industrial, commercial and institutional building. Knowledge of concrete construction as applied to buildings particularly desirable. Permanent position with an old established construction firm; excellent opportunity. Salary, $7,500-$9,000 a year. Location, eastern Pennsylvania. W-7408.

INSTRUCTOR for civil engineering department, with Master's degree, to teach reinforced concrete and related subjects. Will consider applicant with no experience. Salary, to $6,500 for nine months. Available September 1959. Location, Midwest. W-7413.

PRODUCT MANAGER, civil or structural engineering graduate, with at least five years' estimating and field sales experience covering roof decking or allied products. Some traveling. Salary, $7,200-$7,800 a year. Location, Midwest. W-7415.

PROJECT MANAGER, civil graduate, with at least ten years of supervisory heavy construction experience including dams, retaining walls, excavation, etc. Salary, $9,100-$10,400 a year, plus expenses. Location, upstate New York. W-7427.

CONSTRUCTION SUPERINTENDENT, with experience in concrete construction, particularly as applied to flooring and decking. Salary open. Location, New York, N. Y. W-7443.

DESIGN ENGINEERS, graduate mechanical or civil, for the design, construction, maintenance and modification of a variety of mineral processing plants, from small pilot plants to full scale installations. Work requires engineering ability in many fields with responsibility assigned as rapidly as individual capability will permit. Excellent opportunities for advancement. Salary commensurate with experience and responsibilities. Location, South. W-7444.

CONSTRUCTION SUPERINTENDENT with at least ten years' excavating and heavy construction experience including water front pier work and sewage disposal plants. Salary, $17,000 a year, plus bonus. Location, central New Jersey. W-7457.

INSTRUCTOR in civil engineering. Salary dependent upon qualifications; eight and a half month college year. Location, Pennsylvania. W-7546(b).

JUNIOR CIVIL ENGINEER, graduate, with one to three years' experience, preferably in building construction and some on the spot estimating for large insurance company. Salary, $6,500-$7,000 a year. Location, New York, N. Y. W-7547.

PROJECT OR PLANT ENGINEERS, M.E., C.E., E.E., Ch.E., with five or more years' experience. (*a*) Structural, experience on bridges caissons, multistory requiring concrete or structural steel design experience, also required—field and construction experience. (*b*) Electrical, with five or more years' experience required; field and construction experience desirable, primary power distribution systems, control, lighting, interior power systems and specification of equipment. (*c*) Heating, Ventilating, Air Conditioning, five or more years' design experience on process type ventilation, air handling and heating; pressure, temperature and humidity controls, hot water and steam heating systems, refrigeration. Salaries open. Employer will pay placement fee. Location, Chicago area. C-7447.

SOIL ENGINEER, B.S.C.E., Geology or associate fields; two years' experience in highway materials testing, know soils, highway materials and testing procedures. Will direct laboratory testing of soils proposed for highway construction. Three technicians supervising. Carry on special laboratory studies of soils for cement stabilization, occasional travel; no car required. Salary open. Employer will negotiate fee. Location, Chicago area. C-7504.

CIVIL ENGINEER, (Soils Mechanics), B.S.C.E. or Soils Engineering. Three years' professional engineering, at least two of which was in soils work. Will plan and develop complete soils and foundations studies, design and reports for assignments of navigation and flood control projects. Travel and transportation to duty station may be paid if selected. Salary, $7,510 a year. Employer will pay placement fee. Location, Missouri. C-7505.

DESIGN-WATER SUPPLY SYSTEM, CE or equivalent. Able to design distribution systems including storage, pumping and water treatment services for all purposes. $670-750 per month. SF(P)-4440-a

CIVIL DRAFT-WATER SUPPLY SYSTEMS, 8-9 years' experience on streets, sewers, maps; good on ink or pencil. $575-600 per mo. For consultant. San Francisco Peninsula. SF(P)-4440-b

FACILITIES PLANNING-AIR INSTALLATIONS, CE or architectural training, qualifications to assist in or carry out office and field work including some drafting, preparation of specifications, inspection of construction, progress on new or maintenance construction; able to deal with contractors, architects subcontractors and represent the employer in the construction and modification of buildings and services on airfield installation. $475-700 per mo. For aircraft company. San Francisco. SF(P)-4439

SALES-CONCRETE SPECIALTIES, CE or construction background, under 35, technically qualified by construction experience to advise and handle contacts with contractors, construction engineers, designers in selection, use and application of concrete specialties (form ties, precase, prestress). Interest in "hard-hitting" technical sales potential; will train for 90 days. For distributor of nationally advertised products. Car furnished. $450 for 3 months training; then salary and expenses plus 3% commission and bonus—$650 up per mo. San Francisco and San Mateo Counties. SF(P)-4429

OFFICE, FIELD-HYDRAULICS, SANITARY, recent CE graduate, four to five years of experience in general field of civil engineering. For consulting engineer engaged in hydraulics and municipal work, water systems, hydraulic structures, dams, irrigation canals, etc. Salary depends on experience. Discuss payment of placement fee with employer. Northern California. SF(P)-4184

STRUCTURAL DESIGN-INDUSTRIAL, COMMERCIAL BUILDINGS, Prefer CE, age open, with California license and several years' experience designing industrial and commercial buildings; to head new engineering division to be set up by established firm. Salary open. San Francisco East Bay. SF(P)-4420

HYDRAULIC DESIGNERS—DAMS, CE preferred, with minimum three years' experience on design of earthfill dams, spillways, gates, penstocks. Duties, responsibilities and salary depend upon applicant's background. Can use 6 engineers. San Francisco East Bay. SF(P)-4417


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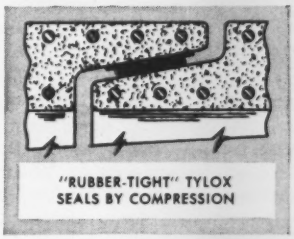


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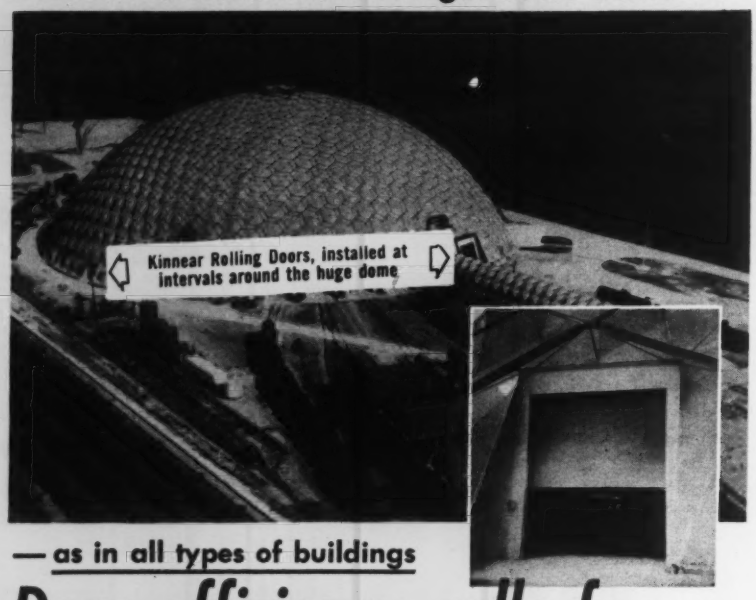


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They open straight upward and clear the entire doorway, coiling compactly above the opening. Surrounding floor, wall and overhead space, *inside and outside the building* is always fully usable whether the doors are opened, closed, or in action. This promotes full use of hoist, crane, conveyor, and lift-truck equipment.

Their *continuous all-metal curtain* gives extra protection against intruders, vandals, troublemakers, wind, weather, and fire.

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## Non-ASCE Meetings

**American Public Works Association.** Annual congress and equipment show in Seattle, Wash., September 20-23. Requests for registration forms and additional information should be addressed to the American Public Works Association, 1313 East 60th Street, Chicago 37, Ill.

**American Society of Mechanical Engineers—American Institute of Electrical Engineers.** Jointly sponsored National Power Conference at the Muehlebach Hotel, Kansas City, Mo., September 28-October 1. Information about the conference, hotels and advance registration available from L. S. Dennegar, Director of Public Relations, The American Society of Mechanical Engineers, 28 West 39th Street, New York 18, N. Y.

**American Society for Testing Materials.** Third Pacific Area National Meeting and Apparatus Exhibit at the Sheraton-Palace Hotel, San Francisco, Calif., October 11-16. For details write to the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa.

**Institute of Traffic Engineers.** Twenty-ninth annual meeting at the Commodore Hotel, New York, N. Y., September 13-17. Further information is available from the Institute office at 2029 K Street N. W., Washington 6, D. C.

**American Water Works Association.** Annual conference in San Francisco, Calif., July 12-17. Address queries to the American Water Works Association, 521 Fifth Avenue, New York 17, N. Y.

**Maryland-Delaware Water & Sewage Association.** Annual Water & Sewage Plant Operators Short Courses in sponsorship with the Chesapeake Section of the AWWA, Delaware State Board of Health, Maryland State Department of Health and the District of Columbia Health Department at the University of Maryland, College Park, Md., September 8-10. Requests for complete programs for the courses will be available about August 1 and should be sent to the Maryland-Delaware Water & Sewage Association, 2411 N. Charles Street, Baltimore 18, Md.

**National Council of State Boards of Engineering Examiners.** Thirty-eighth annual meeting at the Hotel Roanoke, Roanoke, Va., August 20-22. Advance registration cards and hotel reservation forms should be mailed promptly.

**University of California.** First International Conference on Waste Disposal in the Marine Environment sponsored by the University's Sanitary Engineering Research Laboratory and Institute of Marine Resources and the California State Water Pollution Control Board on the Berkeley campus, Dwinelle Hall, July 22-25. Application and program information available by writing to the Department of Conferences, University Extension, University of California, Berkeley 4, Calif.

## Recent Books

*(Continued from page 100)*

reinforced concrete construction, this book discusses the importance of such joints and gives more than 300 examples of the design and construction of buildings and other structures incorporating them: silos, tanks, swimming pools, bridges, harbor works, pipelines, roads, tunnel and mine structures, etc. (By Adolf Kleinlogel. Wilhelm Ernst & Sohn, Berlin, Germany, 1958. 272 pp., bound. 34 DM.)

**Deutscher Ausschuss Fur Stahlbau 1908-1958**
Fourth Edition

The first of the twelve papers in this volume discusses the work of the German Committee on Steel Construction over the 50 years of its existence. The succeeding papers review developments within the same period in steel construction materials, brittle-fracture problems, buckling theory, bridge load and strength analysis, composite construction, light construction for highway bridges, rigid bolted joints, and other topics. (Published by Stahlbeau-Verlag-GMBH, Köln, Germany, 1958. 150 pp., bound. DM 15.)

**Fundamentals of Engineering Drawing**

The basic aspects of the subject involving the use of instruments, lettering, engineering geometry, and multi-view drawing are given at the outset in a revised presentation. In addition the chapters on dimensional practices and on welding drawing are completely revised and a new chapter added on practical sketching. New problems are included as are four hundred new illustrations. Surface shading is now used to permit rapid visualization of three dimensional views and the latest ASA and SAE standards are used throughout. (By Warren J. Luzadder. Fourth Edition. Prentice-Hall, Inc., Englewood Cliffs, N. J., 1959. 720 pp., bound. $10.00.)

### Library Services

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**National Conference on the Administration of Research, Proceedings**

Proceedings of the 11th Conference held in 1957, dealing with the management of scientific and engineering research and with the utilization and career planning of technically trained personnel. Beginning with discussions on creativity, the book continues with the attitudes and motivations of scientists and engineers toward their jobs, measurement of research accomplishment, the size of research and engineering teams, administrative attitudes toward basic research, and studies on basic research in the United States, Europe, and Russia. (Published by the Pennsylvania State University Press, University Park, Pa., 1958. 163 pp., paper. $4.50.)

**Power Plant Theory and Design**
Second Edition

A revised edition of the author's "Steam Power Plants" that covers the entire range of power generating equipment, with particular emphasis upon the steam plant as the basic element. While giving principal attention to large central power station design, the book also discusses the smaller industrial plants, as well as gas, hydroelectric, and nuclear plants. Recent advances are given in the design of such equipment as cyclone furnaces, pressurized boilers, and demineralizing equipment. The economic aspects of equipment selection receive increased emphasis and the proper selection of pipe sizes, insulation thickness, heater terminal differences, and station pressures and temperatures are fully discussed. (By Philip J. Potter. The Ronald Press Company, 15 East 26th Street, New York 10, N. Y., 1959. 710 pp., bound. $10.50.)

SEALTIGHT®
POLYVINYLCHLORIDE PVC WATERSTOPS

**SPECIFICATIONS**

Specific Gravity ..... 1.28 Max.
Durometer Hardness ..... 80 ± 3
Tensile Strength....2600 PSI Min.
Elongation ..... 350% Min.
Temperature Range ..... from +176°F - —50°F
Cold Brittleness Test ..... —50°F ASTM D746 —55T
Chemically resistant to chlorinated water, salt water, acids, alkalis, sewage wastes, oil, etc.

SEALTIGHT PVC Waterstops are extruded from a special PVC compound with added plasticizer and stabilizer to provide all of the necessary qualifications of a true waterstop. The exclusive cross-section design features a unique rib that has a vertical surface on the leading edge and a diagonal surface on the trailing edge to provide a tenacious grip to the concrete in which the waterstop is embedded . . . the special center bulb provides the ability for the waterstop to successfully handle tremendous pressures caused by concrete movements. SEALTIGHT PVC Waterstops are strong and flexible . . . on-the-job splicing may be accomplished quick and easy without special equipment. Ideal for installation in concrete structures of all types. SEALTIGHT PVC Waterstops offer the construction industry the top-quality product in its field at a competitive price . . . specify SEALTIGHT PVC Waterstops when you want a 100% watertight joint.

OTHER SEALTIGHT PRODUCTS

- "PREMOULDED MEMBRANE" . . . the industry's only TRUE VAPOR SEAL.
- "CORKTITE" impermeable Perimeter Insulation.
- "HYDROMAT" Asphalt Liners.
- Expansion Joints of all types.
- Joint Sealing Compounds.
- Tongue and Groove Centerstrip.
- Air Entraining Agents.
- Concrete Curing Compounds.

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# EQUIPMENT, MATERIALS and METHODS

## NEW DEVELOPMENTS OF INTEREST AS REPORTED BY MANUFACTURERS

### V-Beam Sheet

TO SOLVE A LOW-BUDGET CONSTRUCTION problem, Honolulu architects McAuliffe, Young & Associates used Alcoa V-Beam sheet in a single slope for the exterior roof and walls of the single-story cafetorium of Kailua Second High School, Kailua, Oahu, Hawaii. Beneath the V-Beam is a layer of insulation, and an inside finish of perforated aluminum sheet.

Of rigid frame construction, the cafetorium's wood structural system features purlins on 3½-ft centers. Due to the exceptional structural strength of the sheet, the allowable live load of the roof can exceed 40 lb per sq ft.

Perfect acoustics within the building were achieved with the combination of perforated sheet and insulation. Ventilation is provided by vertical jalousie slots of varying lengths. **Aluminum Company of America, CE-7, 1501 Alcoa Bldg., Pittsburgh 19, Pa.**

### New Coupling Method

AN ENTIRELY NEW AND IMPROVED method of coupling industrial compressed air and liquid pipelines is being marketed. The result of more than a quarter century of research by the firm which specializes in the manufacture of steel pipe fittings, Quick Pipe coupling speeds assembly or disassembly and eliminates the need for threading, flaring or flanging pipe joints; no tools are needed for assembly.

The manufacturer claims a saving of up to 90% on installation time and labor with their sturdy, high pressure snap-together couplers. The fittings are designed for use on semi-permanent and temporary compressed air lines, water transport lines, and petroleum or chemical transport lines.

The steel couplers are now available in 2, 3, 4 and 6-in. sizes for use with standard steel I.P.S. pipe or steel and aluminum tubing of all gauges. Pipe contractors and industries can readily convert their present stocks of steel or aluminum pipe and tubing to Quick Pipe at little cost. The couplers are supplied for thread-on, weld-on or press-on installation on pipe sections. **R. H. Pierce Mfg. Co., CE-7, 245 Blair Blvd., Eugene, Ore.**

### Radiant Acoustical Ceiling

THE GENERAL WELFARE OF THE employees, as well as operating efficiency, were influential in the selection of radiant acoustical ceilings for comfort conditioning in the six new buildings housing the International Minerals & Chemical Corporation's new Administrative & Research Center in Skokie, Ill.

Through elimination of radiators, or base board convectors, there is substantially more usable floor space, an especially desirable feature in modern glass curtain wall buildings where the absence of radiators on the outside or perimeter walls is desirable.

When the radiant ceiling is used for cooling in the summer, the operation is reversed. Cool water, with the temperature kept above the dew point to avoid condensation, is circulated through the coil, thus cooling the aluminum panels which then absorb radiant energy from the objects and occupants of the room and helps maintain a comfortable environment.

This radiant ceiling is notable for the lack of maintenance it requires. The aluminum panels are finished in baked enamel, easily cleaned, and may be refinished at any time without impairing the ceiling's comfort conditioning efficiency. **Burgess-Manning Co., Architectural Products Div., CE-7, 5970 Northwest Highway, Chicago 31, Ill.**

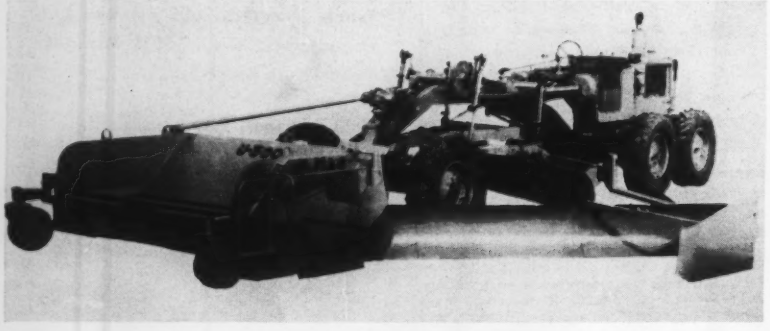
### Shoulder Spreader

SPREADS TO TWELVE FEET CAN be made easily and accurately with any spreadable material including hot mix with the U-500 Shoulder Spreader, which attaches quickly and easily to any Caterpillar No. 12 or 112 Motor Grader. A new scientifically curved blade for "live rolling action" mixes and rolls material out, minimizing segregation and reducing side draft.

Depth of spreads can be adjusted from 6 inches above to 18 inches below the pavement level. Positive manual screw-type depth control adjustment eliminates blade creeping, providing precise and simple depth control.

The U-500 features four wheel suspension with solid rubber tires providing rigid support and stability. All wheels are adjustable, permitting varying the machine height from the pavement. Conveyor height can be matched to dump truck gate heights in this manner, for rapid material movement.

The quick detachable hitch design of the spreader provides rapid hook-ups to the grader and also weight transfer. The entire rear weight can be transferred to the motor grader. **ULMac Equipment Co., Inc., CE-7, El Paso, Illinois.**



U-500

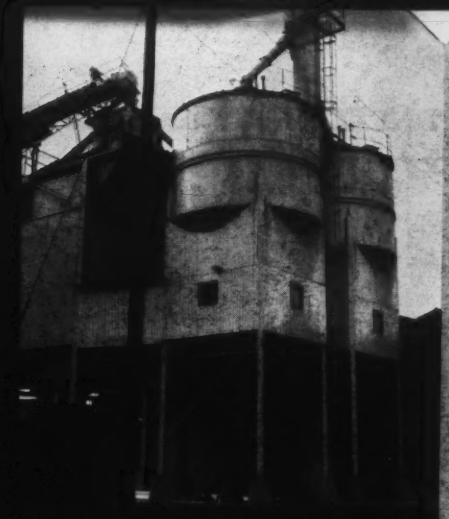
### Power Strapping Machine

THE MODEL M20 POWER STRAPPING machine employs a straightforward mechanical design with power supplied by a standard electric motor. The service and maintenance complications of hydraulic or pneumatic control and power systems are avoided.

There is quick, stepless adjustment of strap tension from 50 lb minimum to the maximum tensile strength of the strap for most sizes; maximum tension with a 3-hp motor is 1600 lb.

Strap tension is applied smoothly without impact, regardless of the stiffness or hardness of the bundle, permitting light gauge strap to be applied to bundles with sharp corners.

There are no limitations on the shape, size or firmness of bundles and packages that may be strapped. The stretching wheel is of the self energizing type requiring no adjustments. No movement of the bundle or package relative to the machine is required during the strapping cycle. Vital working parts are protected by a sealed housing and operate in a bath of oil. **Signode Steel Strapping Co., CE-7, 2600 N. Western Ave., Chicago, Ill.**



Twin 1000-barrel Heltzel Cement Plants are partitioned into four compartments to handle up to four types of cement and fly ash. All compartments are loaded by a common elevator.

# HELTZEL

## twin two-stop manual plant gives ready-mix producer speed, flexibility

By teaming two standard Heltzel batching plants Marion Ready Mix, a leading Pittsburgh concrete supplier, is able to get the high speed production they require during rush periods. Utilizing dual two-stop drive-throughs, four trucks can be handled simultaneously, and different mixes can be batched at the same time by a single batch crew.

Aside from the production advantages Marion is able to handle both plants with a single material handling system. One belt conveyor services all eight compartments of the two 400-ton aggregate plants through an eight-position rotary spout. The four compartments of the two 1000-barrel cement plants are fed by a single elevator through an ingenious system of flop gates. All batchers are controlled from one platform.

The results: Marion charged 30 trucks with aggregate and cement in 35 minutes. A six-yard (19,000 lbs.) aggregate batch was cycled in 45-seconds and a six-yard cement batch in 55-seconds. This from standard manual controls.

If you're not now getting this kind of plant performance why not contact your Heltzel representative for the last word in modern batching technique.
Write today for complete information.

**THE HELTZEL STEEL FORM AND IRON COMPANY**
WARREN, OHIO

*IN TEXAS
...AND THE WORLD OVER
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SURVEYING INSTRUMENTS
*The Bridge Division of the State of Texas Highway Dept. uses Kern Instruments
WORLD FAMOUS FOR
Working Speed
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Accuracy & Economy
DKMI TEN SECOND THEODOLITE (with optical micrometer)
• Exceptional portability and precision.
• Readings automatically ... AT A GLANCE.
• Direct reading to 10". Estimation to 1". Average working accuracy —3-4 secs.
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KERN CENTERING TRIPOD
Unique—a Kern first! Centers instruments in seconds with remarkable accuracy. Assures exceptional stability with ball-and-socket head, supporting instrument coupling.
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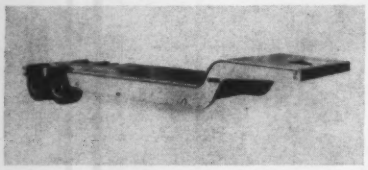
The FINEST in SURVEYING EQUIPMENT
KERN INSTRUMENTS INC.
120 Grand St., White Plains, N.Y.

# EQUIPMENT, MATERIALS and METHODS

(continued)

## Lightweight Trailers

A NEW SERIES OF LIGHTWEIGHT, rear loading semi-trailers fabricated with USS "T-1" Steel has been announced. The new units are available in tandem and 3-axle models with capacities from 32 to 40 tons. All load carrying members are fabricated with the "T-1" Steel, which cuts from 1500 lb to 5000 lb from the weight of the trailers, resulting in less deadweight,



Less Deadweight

greater legal load capacity, less wear and tear on the tractor.

Standard equipment includes the lightweight, high-strength, full width or narrow gooseneck, rubber-mounted axle suspension and longitudinal decking. Optional arrangements include sloping afterdeck, landing legs and extra width and length platform. **Hyster Co., Martin Trailer Div., CE-7, Kewanee, Ill.**

## New Waterstops

A NEW AND COMPLETE LINE of waterstops for construction purposes has been introduced. Made from polyvinylchloride, the Waljohn waterstop offers not only great cost savings advantages over rubber, copper and other metal waterstops, but a new design has been created to allow for maximum movement as the concrete shrinks, expands or contracts.

This design, an inverted "V" heavy center cross-section, is said to offer far greater movement than the old style "U" shape. The company points out that a "V" shape can more naturally follow the foundation shifts, because it will flatten into a straight line without stress, or it can be pinched together without the excess bulk and cracking which would result if the same operation were performed on the "U" waterstop. This design improvement over existing waterstops results in a greater life-span for the waterstops, the manufacturer states. **Waljohn Waterstop, Inc., CE-7, 435-9 88th St., Brooklyn 9, N. Y.**

## Loader-Digger Combination

A HEAVY DUTY FRONT END LOADER and lightning detach power digger employing a common sub-frame and powered from a single Hydra-Loop hydraulic system have just been introduced.

The combining of these two important pieces of construction equipment has been made even more effective with the development of an integrated hydraulic system designed to permit the operation of digger and loader simultaneously. This exclusive system has a full flow filter located on top of a new style fender tank, with built-in relief valve and dirty filter indicator for improved efficiency and ease of maintenance.

The new loader has a breakaway capacity at the bucket lip of 5000 lb and a full lift capacity of 2500 lb on Ford Industrial and Fordson Power Major tractors. With the series 601 and 801 Ford and Fordson Dexta tractors, the loader has a breakaway capacity of 4000 lb and a lift capacity of 2000 lb. In addition, the loader utilizes the same heavy duty subframe as the improved Sherman power digger to eliminate the need for an individual sub-frame. And the digger can be detached in two minutes without the use of special tools, freeing the tractor for other uses. **Sherman Products, Inc., CE-7, 3200 W. 14 Mile Rd., Royal Oak, Mich.**

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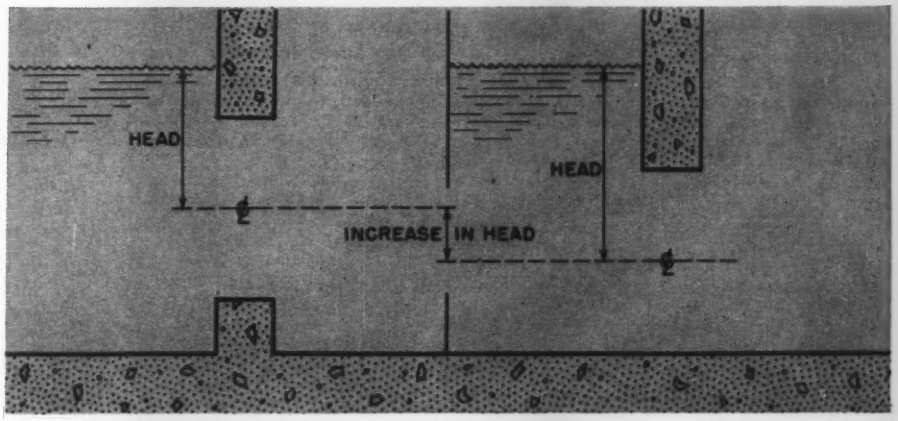
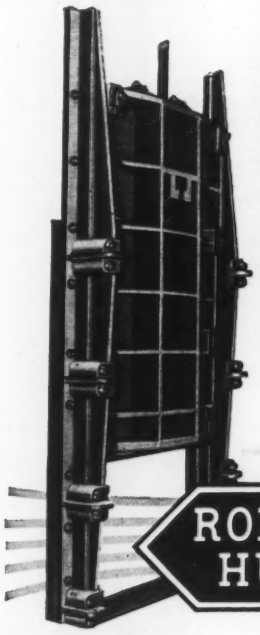
# #4

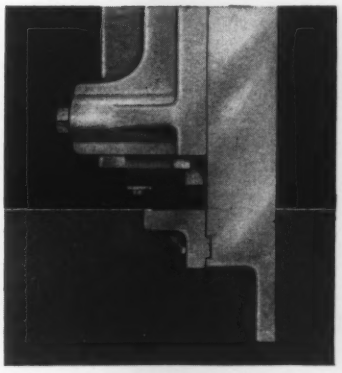
## HY-Q® Sluice Gates Assure Maximum Hydraulic Gradient

**SPECIFY RODNEY HUNT**
**HY-Q SLUICE GATES** WITH FLUSH-BOTTOM CLOSURE
**and get these 6 design advantages**




*In most water control projects—especially in filtration and sewage treatment plants—every fraction of a foot of head is of great importance. With the conventional sluice gate (left of diagram) the raised sill means a sacrifice in pressure. The Rodney Hunt HY-Q Sluice Gate installed flush with the invert (right of diagram) fully utilizes every inch of effective head available to provide greater discharge.*





The many advantages of the Rodney Hunt HY-Q Sluice Gate derive from the design of the resilient seal fastened to the bottom of the disc as illustrated at the left. This seal extends the full width of the disc and provides a cushioned closing at the stop bar *flush with the invert.* This flush-bottom closure assures—**1.** maximum flow — **2.** complete drainage without pumps or piping—**3.** elimination of silt and debris problems—**4.** maximum hydraulic gradient—**5.** lowest possible invert—and—**6.** construction economy.

In brief, the HY-Q gate offers unmatched design flexibility and construction economy for water control projects...with hundreds of gate sizes available from 6" x 6" to 144" x 144" and larger to meet your specific design requirements.

**HY-Q** The sluice gate with flush-bottom closure

RODNEY HUNT

**HY-Q SLUICE GATE**
*a product of*
**RODNEY HUNT MACHINE CO.**
Water Control Equipment Division
86 Water Street, Orange, Mass.
Serving water control engineers with equipment and engineering

## Stereomat

A NEW INSTRUMENT CALLED A Stereomat, which automates the production of maps from aerial photographs, will perform automatic profiling and semi-automatic contouring.

This instrument has great possibilities in many fields which require fast, accurate mapping service. It could lead to a process for making completely restituted or corrected aerial photographs on a production basis, which might eliminate the need for conventional maps in many cases, thereby opening a whole new concept of aerial photogrammetry.

The Stereomat will also greatly simplify highway profiling, cross-sectioning, stereo-triangulation, preparation of terrain models, and computation of earthwork quantities. Its use will result in substantial savings in the cost of highway construction.

The new device is more reliable than the human eye and hand, and it speeds the production of contour lines at least five times, the manufacturer states. Operators will still be required for Stereomat-equipped plotters. Since they will be relieved of the mechanical drudgery of contouring, however, they will be able to concentrate on problems requiring interpretation and judgment. **Benson-Lehner Corp., CE-7, 11930 W. Olympic Blvd., Los Angeles 64, Calif.**

## Bin Level Indicator

A NEW, AUTOMATIC BIN LEVEL INDICATOR, especially suited to applications where corrosion and chemical action may be factors, has been introduced. A super-sensitive response mechanism effective for use with light materials without affecting its performance with heavy materials or for general purposes, it is offered in both standard and explosion-proof models with U.L. label.

Named the Auto-Bin-Dicator, it differs from related units in the line in that the entire body is heavy aluminum castings and the diaphragm is stainless steel, making it corrosion resistant, even when it is installed in a suspended central position in the bin, completely enveloped by material.

The controlled movement of the spring-loaded stainless steel diaphragm and the sensitivity of the switch mechanism make the indicator extremely responsive to changes in pressure of materials, and it functions as effectively in controlling levels of light, low density materials as it does when handling heavy, dense, coarse or abrasive materials. **Bin-Dicator Co., CE-7, 13946-45 Kercheval, Detroit 15, Mich.**

## Liquidfluxer and Liquidflux

THE NEW LIQUIDFLUXER FEATURES A constant unobstructed flow of flux, maintained without the use of wicks to clean or to replace. There are no shutdowns of operations for replenishing the flux supply. A separate valve is provided for outlet, inlet and bypass of the gas, enabling the exact amount of flux desired for any brazing operation. A quick glance at the non-clouding liquid level gauge reveals the exact amount of flux in the fluxer at all times.

The new improved Liquidflux is vaporized and inducted into the gas stream automatically as required, and passes through the welding torch into the flame. No special torch is needed. Inasmuch as the correct amount of flux is used automatically, no crystaline residue is formed, therefore, no after-cleaning of the metal part is required. As the flame contacts the metal part the flux in the flame cleans and fluxes the parent metal for brazing, therefore no precleaning is required.

Liquidflux may be used for brazing non-ferrous metals to steel and iron, and for welding of copper, brass, bronze, cast iron and malleable iron. Silver soldering operations are greatly improved with the use of Liquidflux when used in conjunction with regular silver solder flux. **The Sight Feed Generator Co., CE-7, 38 E. Third St., West Alexandria, Ohio.**

Specify
KERRIGAN Weldforged
GRATING & TREADS...
...for ECONOMY and SAFETY
To give you an extra margin of safety Weldforged Grating's spiral bars alternate right and left and are slightly raised above bearing bars. One-piece units are match-marked for easy installation. Send now for free catalogs on both steel and aluminum grating.
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KERRIGAN IRON WORKS CO.
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## Pre-Print Paper

THE MANUFACTURER STATES THAT THIS innovation in technical papers provides a pre-print of recurring typical details, basic standards, title block information, bills of materials, legends and symbols. In addition, optional items of frequent recurrence are printed in the "Fadeout" process on Pre-Print paper. When desired to appear in the final printing, pre-printed details are simply pencilled or inked over.

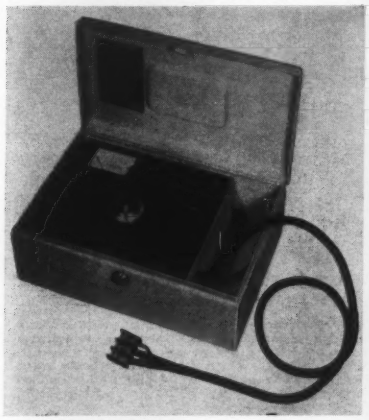
Pre-Print is printed on Clearprint #1000H or 1020 paper with "Fadeout" lines on the reverse side permitting repeated erasures without destroying the guide lines. It gives draftsmen and engineers a head start and saves drafting and lettering time. "Fadeout" lines completely disappear when drawings are made into blue prints. **Clearprint Paper Co., CE-7, 1482—67th St., Emeryville, Calif.**

(continued)

## Portable Corrosion Tester

A NEW LIGHTWEIGHT CORROSION TESTER that reads directly in micro-inches of corrosion has been designed to meet the needs of the industrial, scientific and engineering fields to help control the six-billion dollars worth of damage done annually due to corrosive elements.

Uses for the Corro-Dex corrosion tester include corrosion testing in paper and pulp plants, chemical manufacturing, plastic industry, oil well piping; cathodic protection of marine structures; tanker corrosion; corrosion in storage tanks and engines and determining the current density for minimum cathodic protection.



Lightweight

The unit is battery operated and applies AC current to the probes, eliminating polarization and undesirable side effects. A single knob controls a sensitive transistorized bridge circuit which works on the null principal with only one dial adjustment necessary for all readings. **Soiltest, Inc., CE-7, 4711 W. North Ave., Chicago 39, Ill.**

## Durable Plastic-Base Paint

HIGHLY SUCCESSFUL PERFORMANCES over the past 12 years by swimming pool paint based on Bakelite vinyl resin have dictated use of the coating to protect a large pool in Pennsylvania.

Inspection of more than 30 previous pool applications, along with extensive chemical, abrasion and exposure tests, proved the plastic-base Amercoat paint provides superior resistance to corrosion and chlorine attack. These advantages show Amercoat vinyl paints to be superior to other types of coatings, according to pool fabricators, Benson Engineered Products, Inc., Cranston, R. I.

Inspection of the other pools installed by the fabricator and coated with the same material, revealed that after a year of service, only 10% required any maintenance and that, despite excessively rough usage, consisted only of minor retouching. The remaining 90% of the paint jobs were still in excellent condition and should last at least another year before a clean fresh coat is applied over the original coating. **Union Carbide Plastics Co., CE-7, 30 E. 42nd St., N. Y., N. Y.**

## Precision Circle Cutting Attachment

A NEW PATENTED TOOL, costing about one-tenth that of large complicated machines, is being manufactured for cutting precision holes and various shapes in thick metal plate. Developed for use by the U. S. Navy, the Or-O-Co precision

*(Continued on page 116)*


for a wise investment specify a **NATIONAL pool** . . .

• **a life-time pool investment** . . . durable as a wall of rock . . . assembled quickly and at lower cost with National's unique prestressed interlocking concrete units into a triple wall capable of withstanding the severest temperature and other stresses . . .

• **a trouble-free pool installation** . . . sparkling as a mountain brook . . . operated continuously with fully automatic National controls and equipment that assure the lowest possible operating expense . . .

. . . **NATIONAL pools** . . . specified by architects and engineers for America's finest country club, community, hotel, school and military pools . . . widely approved by State Boards of Health . . . produced in a wide range of sizes and shapes to meet your needs . . . fully equipped as required with all filters, heaters, underwater lights, skimmers, chlorinators, fittings, vacuum cleaners, ladders, diving boards, safety equipment and other accessories . . .

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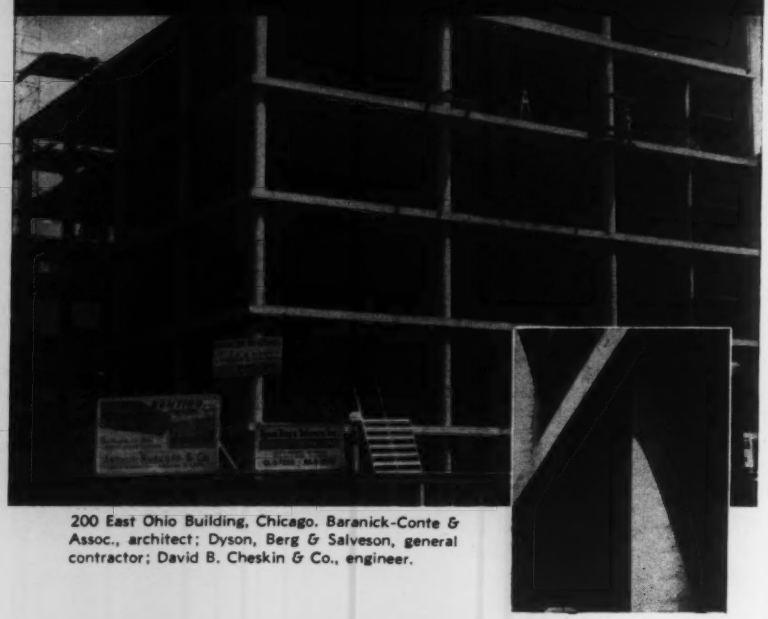
# Faster Forming
## of round concrete columns



200 East Ohio Building, Chicago. Baranick-Conte & Assoc., architect; Dyson, Berg & Salveson, general contractor; David B. Cheskin & Co., engineer.

**Use low-cost, easy-to-handle**
**SONOCO**
***Sonotube*® FIBRE FORMS**
**to speed construction, reduce cost**

Ninety-five round columns of concrete provide vertical support for this downtown Chicago office building. To save time, labor, and money, the columns were formed with low-cost, patented "A" coated Sonoco SONOTUBE Fibre Forms.

Flexible in use, Sonoco Fibre Forms can be sawed to fit specific job requirements. Integrate with slab forms, punch for conduits or bolt anchors, or use to form obround or half round columns.

Lightweight and easy to handle, Sonoco SONOTUBE Fibre Forms require only minimum bracing and strip quicker, finish easier . . . provide the fastest, most economical way to form round columns of concrete.

Choose from 3 types: Seamless (premium form for finished columns), "A" coated (standard form for exposed columns), and wax coated. Sizes from 2″ to 48″ I.D. Order in required lengths or standard lengths of 18′.

**See our catalog in Sweet's**
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3650

**SONOCO**
*Construction Products*
SONOCO PRODUCTS COMPANY


# EQUIPMENT MATERIALS and METHODS

**(continued)**

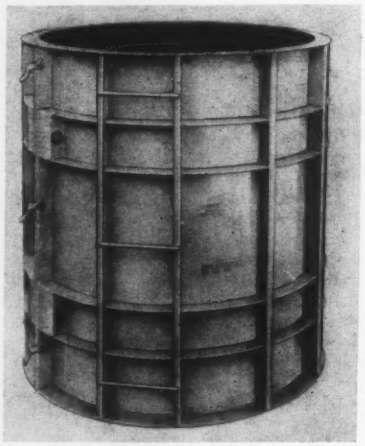
cutting tool attaches to any acetylene cutting torch for such applications as cutting holes through metal walls and decks for pipe and electrical conduit.

Squares, rectangles, and odd-shaped holes and solid figures can also be accurately formed for welding fabrication. Because of the tool's small size it will operate in confined spaces, heretofore usually performed by laborious and expensive free-hand cutting. **Ideas, Inc., CE-7, 214 Ivinson Ave., Laramie, Wyoming.**

## Bridge Column Forms

DESIGNED PRIMARILY FOR USE IN bridge and overpass construction, the Bridge Column Forms are ideal for all types of heavy construction where sturdy columns are needed, and are also adaptable to other uses, such as the forming of pier nosings. For this purpose, they are combined with regular EFCO Forms, the latter being used to form the sides of the pier.

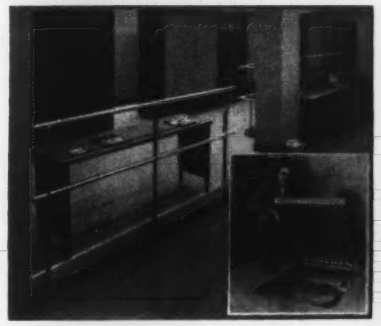
Easy-operating plate clamps are utilized on both horizontal and vertical joints; the clamps used vertically are for fast erection only, to save valuable crane time. After the crane used in the column form erection has been moved to other productive work, bolts are then placed and tightened to provide full strength of form design.



Easy Stripping

Since the forms are precision-made, stripping is easy. A crane simply lifts off the form vertically as though it were a sleeve. **Economy Forms Corp., CE-7, Box 128-G, Highland Park Station, Des Moines, Iowa.**

# WASHINGTON ALUMINUM FLOORING FITS EVERY REQUIREMENT



**RAISED PANEL FLOORING**

Wherever equipment for industrial processing data handling and computing must be installed, specify Washington Aluminum raised flooring. Cut-outs can be made anywhere without weakening panels. Weight is supported as desired with deflection less than 1–360th of span. Panels easily lifted with simple suction device. Maintenance-free. Cabling, ducts beneath panels are easily accessible.

**NON-SKID FLOORING**

Wherever safe footing is desired, here's the answer. Upset design provides non-skid traction in all directions even under wet or greasy conditions. Exclusive I-Beam design rivals structural strength of steel at a fraction of the weight. Can be fabricated to any length or width; for any weight load.

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## EQUIPMENT MATERIALS and METHODS

**(continued)**

### Logging Lift Truck

ALTHOUGH DESIGNED PRIMARILY TO MEET current demand for heavy-duty equipment for fast handling of logs and lumber, the Hydra-Stack also has a broad potential field of other applications, such as in railway work or wherever extra power and ruggedness are major considerations.

To match its over-all huskiness, this truck is powered by a new Hercules liquid-cooled gasoline engine which has

Four-Wheel Drive

298-cu in. displacement and develops 260 ft lb of torque at 1500 rpm and 92 hp at 1800 rpm. Among the special features of this engine are center spark plugs and separate intake and exhaust manifolds.

The Hydra-Stack also features a lifting capacity of 16,000 to 24,000 lb, four-wheel drive, four-wheel brakes, power steering, four speeds forward, four speeds reverse, 88-in. wheelbase and a short turning radius. **Patrick Equipment Co., CE-7, 1250 Charles St., Vancouver, B. C.**

### Scrap Handler Attachment

A 1200-LB CAPACITY, HYDRAULIC SCRAP handler attachment capable of dumping at a height of 7 ft has been developed. High capacity of the claw-like unit permits handling large loads of lathe turnings, light gauge blanking scraps, bales, hides, strips or other objects that do not easily conform to normal bucket type handling.

The attachment's hydraulic dumping action and high reach allow for loading this material into normal open truck carriers or collecting it in tall, space-saving containers or piles.

The attachment itself consists of three components: seven rigid, carrying forks welded to a 48-in. wide carriage; four, more widely spaced, hydraulically controlled clamping forks which close against the carrying units to hold the load and

*(Continued on page 118)*

# NO-LEAK PUMP FOR VOLATILE FLUIDS

## JOHNSTON VERTICAL UNIT-LINE

- No mechanical seal to abrade or corrode.
- *Positively will not leak fluid or vent vapor to atmosphere.*
- Applications wherever safety and maintenance are factors. Takes small surface space.
- For installations where pump's supply is vented to atmosphere.
- Developed for Atomic Energy Commission for handling radioactive wastes.

Dealers in all principal cities.

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# JOHNSTON PUMP COMPANY

**A Division of The Youngstown Sheet and Tube Company Pasadena, Calif.**

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separately controlled hydraulic kick-off forks which sweep material from the carrying surface in dumping.

Loads are picked up by ramming the attachment into a pile of scrap and then hydraulically closing the upper forks to secure the load before backing the tractor shovel from the pile. **The Yale & Towne Mfg. Co., CE-7, 11,000 Roosevelt Blvd., Philadelphia 15, Pa.**

## Front End Telescopic Hoist

ONE OF THE OUTSTANDING FEATURES of this front end telescopic hoist for 8, 9 and 10-ft bodies is the ease in which the cylinder is attached to the body, a method which not only speeds up installation but also allows fast, easy detachment for any servicing of the hoist in the field.

The top connection is attached to the top of the cylinder before the body is installed. Then as the body is let down, the cylinder will guide itself into place in the cylinder housing. The body is then secured from the outside at the top by two bolts that fasten it to the weld plate that is already attached to the hoist.

The oil reservoir with these model hoists is mounted on the side of the frame, making it possible to use a deep tank to provide a quieter, cooler, more efficient hydraulic system and eliminate the danger of drawing air into the system.

Other benefits and features include a weight savings of from 65 to 90 lb; a standard-duty pump with a safety relief valve; and fast dumping speed. The hoists mount in their own sub-frames to provide a rugged, sturdy unit. **Marion Metal Products Co., CE-7, Marion, Ohio.**

## Portable Lighting System

ACCORDING TO THE MANUFACTURER, THE Wide-Lite Portable Lighting System is excellent for lighting highway jobs, pit or quarry operations, shovel areas, cut and fill sections, grading and strip mining operations. With the use of just eight towers supporting a total of 24 lights, the unit is capable of near daylighting over ½ mile of highway construction.

The lighting system comes equipped with ballast transformers for the Mercury Vapor Lamps, Heavy Duty 300 ft or 500 ft conductor cable for connections between towers, three Wide-Lite Mercury Vapor Lights per tower and six conductor cables connecting the ballast transformers with the lamp.

Consists of Eight Trailers

It consists of the D311-M Diesel Electric Set, eight telescoping towers, eight Trailers, six 300-ft long conductor cables, two 150-ft long conductor cables, waterproof plugs and receptacles for connections to the generator and the towers, and completely detachable lamp crossarms which can be removed from the telescoping towers for easy handling. **Thompson Tractor Co., Inc., CE-7, 500 North 28th St., Birmingham, Ala.**

## New Glass-Like Coating

ACCORDING TO THE MANUFACTURER, this new Poly-Form non-toxic urethane protective coating is reported by enthusiastic users to save constant maintenance expense, as it lasts from 4 to 6 times longer than conventional coatings, and covers 2 to 3 times more area per gallon.

The coating can be brushed, sprayed, rolled or dipped on wood, concrete, metal, fiberglass, and fabrics. It retains its beauty longer (no need for waxing) as the glass-like film seals out the destructive elements that attack and destroy most coatings. It is excellent for boats, swimming pools, patios, redwood, industrial machinery and buildings, floors, and stall showers. **Poly-Form Mfg. Co., CE-7, P.O. Box 305, Escondido, Calif.**

TUBULAR *RAILINGS*

Pictured is one of the many types of Tubular Railing. This railing is made from a combination of standard pipe and square and rectangular tubing. Its design offers extra strength and durability with many years of service—at minimum maintenance. For superior design and quality construction, specify Tubular Railing on your job.

TUBULAR Products, Inc.

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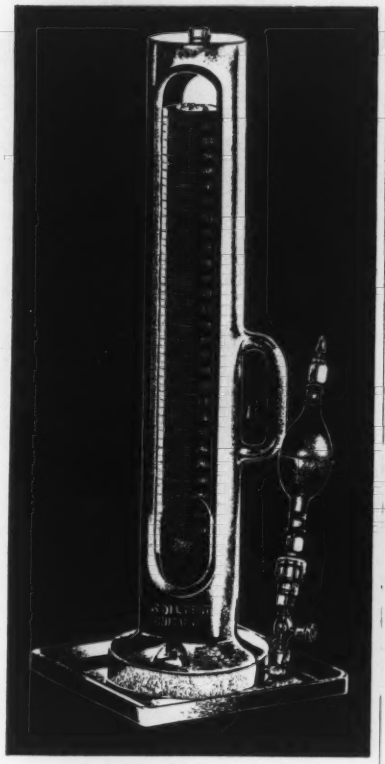

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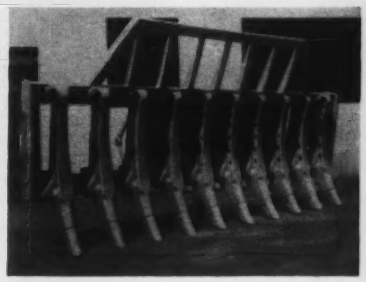
## EQUIPMENT MATERIALS and METHODS

(continued)

### Multi-Application Rake

THE DESIGN OF THE NEW Multi-Application Rake is the result of years of research and development of a rake that could handle the widest variety of clearing tasks, including rock and tree removal, rip-rap sorting and other construction, industrial and agricultural work.

Any Series H Caterpillar D8 Tractor equipped with a straight or angling dozer can be quickly converted to a high production clearing tool with the addition of the rake. The heavy-duty, cast manganese carbon steel teeth can be equally spaced along the all-welded, bar-beam



Rock and Tree Removal

frame in any sequence from 5 to 10 teeth, thus allowing the user to match soil or material conditions, as teeth can be spaced to permit wet or hard soil to sift through. Each tooth is backed by a steel gusset and is curved to give a rolling action to the load, reducing tractor effort, as well as to exert leverage to lift out boulders and stumps.

The rake has flush-fitting wear caps on each tooth which greatly prolong service life. A heavy reinforcing plate in the center of the frame also increases protection for the tractor's radiator area against snags, limbs and rocks thrown up in operation. **Fleco Corp., CE-7, P. O. Box 2370, Jacksonville, Fla.**

### Concrete Fatigue Damage Study

BELIEVED TO BE THE FIRST to be conducted in the United States, this investigation is to study plain concrete specimens subjected to flexural stresses of varying magnitude and sequence.

Results of these fatigue tests are expected to yield valuable new information about the general behavior of concrete subjected to loads of varying magnitude followed by rest periods or high static overloads. **American Machine & Metals, Inc., Riehle Testing Machines Div., CE-7, East Moline, Ill.**

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## Sidewalk Canopy Frames

A NEW PRODUCT HAS JUST BEEN added to the company's line of scaffolding and shoring equipment. This item is designed to provide a quicker, easier method of making sidewalk canopies for pedestrian protection around construction sites using "Trouble Saver" Scaffolding components. The frames are 7 ft 6 in. high by 6 ft wide and are composed of tubular steel members designed with reinforcing sections.

When assembled with diagonal braces, base plates and adjustable legs, a simple, yet strong, sidewalk canopy section of any length can be achieved. The 7 ft 6 in. height provides plenty of headroom for pedestrians. Additional sectional scaffolding may be erected on planking laid across the tops of the frames. **The Patent Scaffolding Co., Inc., CE-7, 38-21 12th St., Long Island City 1, N. Y.**

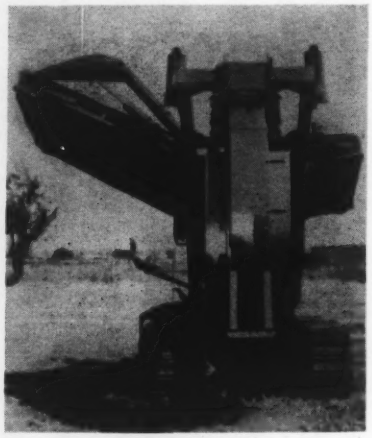
## Norman Header

CONTRACTORS AND BUILDERS IN MANY areas have shown more than just ordinary interest in the Norman Header which is now available in smooth, velour, and stipple-matt textures. Especially made as a masonry bonding unit for 12-in. walls, it can also be used by itself for 8-in. walls.

The manufacturers say that there are three distinct advantages in using the Norman Header: it permits a sturdy masonry bond in comparison to the metal wall type; the face of the Norman Header unit is the same as the Norman exterior brick, so the exterior face brick does not show any header course; and it is made in 8-in. size but can be used equally well for 12-in. walls. **Adel Clay Products Co., CE-7, 101 Ashworth Road, West Des Moines, Iowa.**

## New Trencher

A HIGHLY POPULAR MODEL FOR TRENCH up to 3 ft wide and down to 6 ft, 3 in. deep, the 240 Trencher is now equipped with a 12 ft x 2½ ft power-shifted, power-folded, V-shaped conveyor, which provides a constant elevating angle for faster, higher spoil discharge, reduces rolling and tumbling of spoil, and gives maximum clearance under the digging wheel rims, accommodating higher heaped loads without clogging.



Power-Shifted

As controls for the hydraulic shifting, positioning and folding of the conveyor are located at his seat, the operator can power-shift and power-position the conveyor quickly and easily, without interrupting other operations of the trencher, to dig past poles, trees, fences and other obstructions, discharging spoil where required.

The 240's crawler has double-flanged wheels, rollers and sprockets with wide-spaced teeth, drives on each end 1½ in. dia hardened crawler pins, eliminating pockets which cause plugging with dirt and stones. This double support and drive provides greater stability and lengthens wear life of the track. **Cleveland Trencher Co., CE-7, 20100 St. Clair Ave., Cleveland, Ohio.**

## Weather Dock Enclosures

HOW TO MAKE LOADING DOCK enclosures really weatherproof and trouble free was a question which arose during the recent construction of a 14,000-sq ft warehouse extension.

It was suggested that they be tailor-made to assure proper fit and a different, completely waterproof and weather resistant material be used. The material selected was neoprene coated nylon, manufactured under the trade name "Coverlight".

After more than one year of operation, the dock enclosures have proved well worth their initial costs. None of them has required any repairs so far, and none of them shows any signs of wear and tear. On the other hand, they have resulted in a number of substantial savings during loading and unloading operations.

*(Continued on page 121)*

**How to handle WET JOBS** #48 of a series

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## EQUIPMENT MATERIALS and METHODS

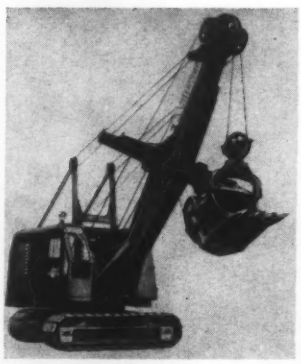
**(continued)**

Some of the savings include: a reduction in the cost of heating; spoilage of merchandise is practically eliminated; employees are more comfortable and can work more efficiently with less interruptions; and in cold weather, the enclosures prevent freezing of the metal plates bridging the warehouse floor and the railroad cars, thus eliminating a serious hazard. **Reeves Bros., Inc., CE-7, 1071 6th Ave., New York 18, N. Y.**

### New Shovel

NEWEST ADDITION TO THE COMPANY'S line of power cranes and excavators is the Model 3100, a 2½ yd shovel which is easily converted to clamshell, back hoe, dragline or crane. Although big in capacity, it handles, travels and can be moved from job to job with small machine ease. For movement by truck or train, complete crawler assemblies are easily removed bringing width and height well within ordinary shipping clearances.

Greatest shovel boom strength is obtained through the use of an exclusive alloy steel boom welded in elongated tubular form. The crowd mechanism of the



Model 3100

3100 is carefully positioned to eliminate off-center strain on the drum shaft. A powerful, smooth disc-type clutch on the main drive shaft powers the high speed retract.

The crawler base is engineered for longer life of service, minimum maintenance and permanent alignment of all components. A huge, single piece carbody is fastened directly to the crawler frames. Other features include a huge, 9½ dia alloy steel king pin; self-cleaning crawler drive; and simple jack adjustment of crawler treads through the use of adjustment shims. **Manitowoc Engineering Corp., CE-7, Manitowoc, Wisconsin.**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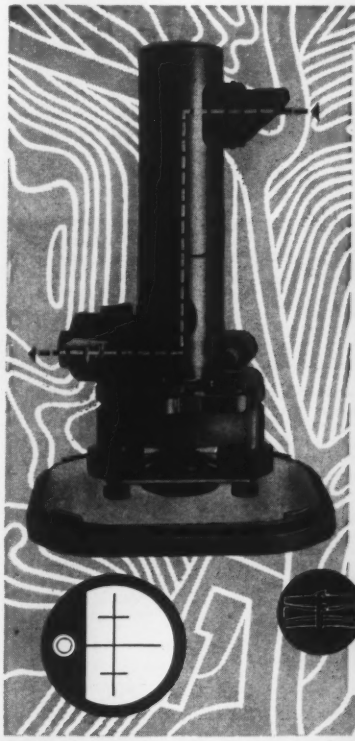

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## Hand Protection

A NEW PROTECTIVE PRODUCT IS NOW available for the engineer with hands exposed to poison oaks, chemicals, oils, grease, solvents, plastics, and paint.

Vanfaire provides an invisible protection against resulting rashes. Applied like any hand lotion, it is soluble in soap and water and protects the hands up to 12 hours. After many tests it is now being used widely by the plastic, aircraft, electronics, and chemical industries on the West Coast. **Vanfaire Co., CE-7, 10732 Riverside Drive, North Hollywood, Calif.**

## Portable Shelters

THE DEVELOPMENT OF PORTABLE SHEDS to protect outdoor workers on the ground has been announced. Designed to withstand winds up to 40 miles an hour without being anchored, the sheds are constructed of a braced steel frame with heavily galvanized steel siding and roofing. To admit daylight, corrugated plastic sheets have been let into the roof. For artificial light, to permit work to continue after dark, each shed is wired for electric flood lights.

One of the unique features of the portable sheds is that they can be stacked one on top of another when not in use, to conserve space on the job.

Each shelter is 16 ft 9¾ in. high, offering a maximum work height under the peak of about 14 ft. Interior height where the sloping sides meet the roof is 7 ft 3 in., providing ample height for work on large pieces. The shelters allow work to go on out of doors at times when weather would ordinarily halt it. **Luria Engineering Co., CE-7, 511 Fifth Ave., New York 17, N. Y.**

## The Avol Rule

ACCORDING TO THE MANUFACTURER, the old average end area method of computing volumes of earth work quantities has been eliminated through the use of the newly patented Avol Rule. Field testing of the device has revealed very impressive savings, and enthusiastic comments of civil engineers across the country foretell of almost certain general acceptance of this new method of area-volume measurement, the company states.

Adopted recently by several Federal Agencies and State Highway Departments as an improved means of obtaining rapid and accurate measurements of areas and volumes, engineers claim the tool to be much faster, more accurate and less fatiguing to operate than a Planimeter.

It has been further proved that about six man hours of labor per mile are saved in computations when the Avol is used as compared with the average end area method. **Engineering & Marketing Associates, Inc., CE-7, Lobby E—Terminal Sales Bldg., 1220 S.W. Morrison St., Portland 5, Oregon.**

## New Backhoe

FEATURING HYDRA-SLIDE POSITIONING, the new Davis 220 Backhoe makes it possible for one man to move the entire digging assembly along the frame to any of five positions in less than five minutes.

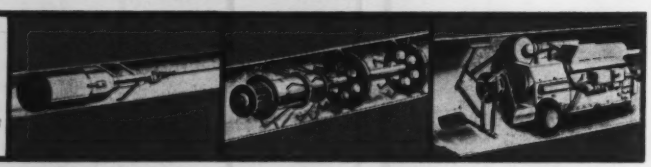
The operator's seat and controls move right along with the digging assembly, so the operator is always directly in line with his work. This—coupled with the fact that the seat always revolves with the boom—provides the operator with excellent vision for precise digging assignments.

Hydra-Slide Positioning

Other improvements include increased operating pressure to 2,150 psi, larger bucket cylinder for 50% faster dumping, and a greater breakway power up to 14,000 lb. **Massey-Ferguson Industrial Division, CE-7, 1009 South West St., Wichita, Kansas.**

REHABILITATE
OLD, CORRODED OR LEAKY
PIPE LINES

3 processes



THE TATE PROCESS is for pipe diameters from 4" to 16" and is done, "in place," after by-pass lines are set up to carry on with water service.

First, the pipe is scraped and cleaned. Then, cement mortar is fed in and applied under pressure to a compact thickness of 3/16" to 1/4" giving the final effect of one continuous, cement mortar lined tube.

THE SPUNLINE PROCESS is partly TATE and partly centrifugal, developed to provide a thin lining for preventing corrosion and to restore hydraulic flow, particularly in cast iron pipe. The cement mortar lining can go through bends and past openings. It can be applied "in place." Uninterrupted continuity is obtained.

CENTRILINE Centrifugal Process. Cement mortar lining ingredients are mixed to rigid requirements and applied under a high velocity spray with uniform speed. Rotating steel trowels spread the mortar to a smooth, hard finish. Pipe sizes vary from 16" on up to 144". Clay, cement, brick, steel, cast iron and wrought iron pipes may be CENTRILINED.

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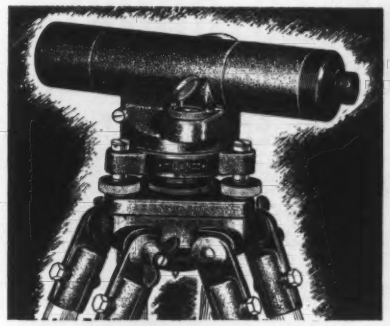

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# Literature Available

CALCIUM CHLORIDE—Written especially for highway engineers, contractors and material suppliers who are using calcium chloride, Manual HM-1 "Calcium Chloride—Handling, Storing and Applying" provides data on approved methods for handling, storing and applying calcium chloride. A special section includes winter maintenance data. Also available is Manual SM-1 "Calcium Chloride for Stabilization of Bases and Wearing Courses", which deals with properties and design, types and methods of construction and specifications. **Calcium Chloride Institute, CE-7, 909 Ring Bldg., Washington 6, D. C.**

ENGINES AND POWER UNITS—Two new catalogs covering the G-226 and the G-149 engines and power units are now available. Both booklets tell the design, engineering and performance capabilities of the units with the help of numerous illustrations, including a center spread devoted to a cross section of the unit with descriptive marginal notes. Optional equipment available is also listed. **Allis-Chalmers Mfg. Co., CE-7, 864 S. 70th St., Milwaukee, Wis.**

FLOTATION TIRES—This 64-page illustrated catalog shows specifications and prices of flotation tires for all types of off-the-road vehicles. It describes and illustrates applications of flotation tires for construction graders, loaders and scrapers; pulpwood skids, house mover dollies, mine trucks and other heavy duty equipment. Matching tubes, wheels, rims and stub axles are also shown. **Harmo Tire & Rubber Corp., CE-7, 1050—18th St., Detroit 16, Michigan.**

CONDULETS FOR CORROSIVE LOCATIONS—In this new 16-page bulletin corrosion-resistant properties of a variety of metals and finishes used in the Condulets are described, with simple charts showing the applications of each. The booklet also contains first formal listings of Plast-A-Coat Condulets for hazardous and non-hazardous locations. **Crouse-Hinds Co., CE-7, Syracuse 1, N. Y.**

DOCKS AND PIERS—A new, 24-page booklet describes the patented De Long Jack and the De Long method of designing and building self-elevating docks, piers and offshore drilling platforms. Projects recently completed are reviewed and illustrated. Among these are mobile work platforms in operation at Los Angeles, Calif. and Wilhelmshaven, Germany; a coal dock in the East River, New York City; a pier and tramway at Fort Eustis, Virginia; and the ADMA Enterprise, first mobile drilling platform to be used in the Persian Gulf. **De Long Corp., CE-7, 29 Broadway, New York 6, N. Y.**


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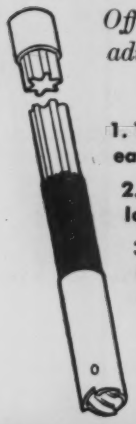

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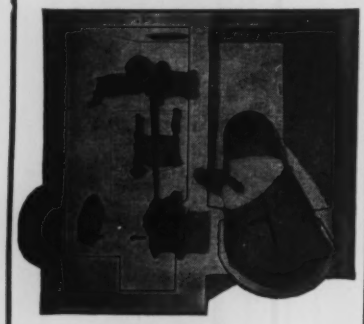

**Fig. B-19**

**Automatic Sewage Regulators control sewage flows either by partially or completely cutting off such flows to suit head or tail water conditions or by "governing" to discharge a predetermined quantity regardless of head or tail water conditions.**

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OPEN-WEB STEEL JOISTS—Open-web steel joists, steel roof deck, and Cecor centering, for construction of light-weight, economical, and safe roof and floor systems are fully described in a new 28-page booklet #3001-0 and an accompanying Load Tables bulletin #3009-A. Booklet 3001-0 contains complete descriptions and diagrams of open-web steel joists, including Series "S", "L", and "E/C". It contains tables of available dimensions, allowable loading, complete specifications, and recommended handling and erecting procedures. **Ceco Steel Products Corp., CE-7, 5601 W. 26th St., Chicago 50, Ill.**

ALUMINUM COMMERCIAL BUILDING PRODUCTS—A new brochure on "Lifetime" aluminum commercial building products has been published as a service to architects, engineers and contractors. The file folder contains separate brochures on commercial acoustical systems, corrugated roofing and siding, field-assembled insulated wall system, roof deck, ribbed embossed siding and V-beam roofing and siding. Information given in the brochures includes uses, advantages, erection methods, specifications and accessories. **Reynolds Metals Co., CE-7, Dept. PRD-8, Richmond 18, Va.**

COAL & ROCK LOADING MACHINE—A few of the topics included in this 17-page catalog are: a general description of the "Automat" Shoveling Machine; its advantages, such as safe loading of coal, rock and ore; excellent shovel action; loading bigger cars; and low power consumption; the operation of the machine; and specifications. **Myers-Whaley Co., CE-7, Whaley Bldg., Knoxville, Tenn.**

INDUSTRIAL TRACTOR TRAILER—Literature is available on the Totem-All Trailer, which moves equipment easily, quickly and inexpensively. Hitched to a light pick-up truck, it hauls small crawlers, tractors with front-end loaders, backhoes, scraper blades and trenchers to the job site. Specifications and illustrations are included. **Birmingham Mfg. Co., Inc., CE-7, 14 South 55th St., P. O. Box 2805, Birmingham, Ala.**


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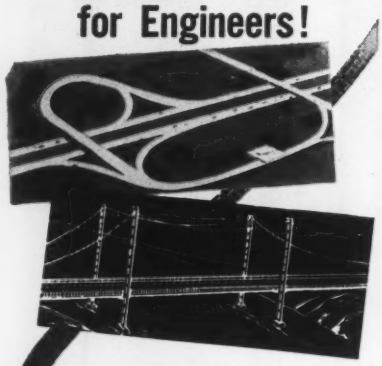

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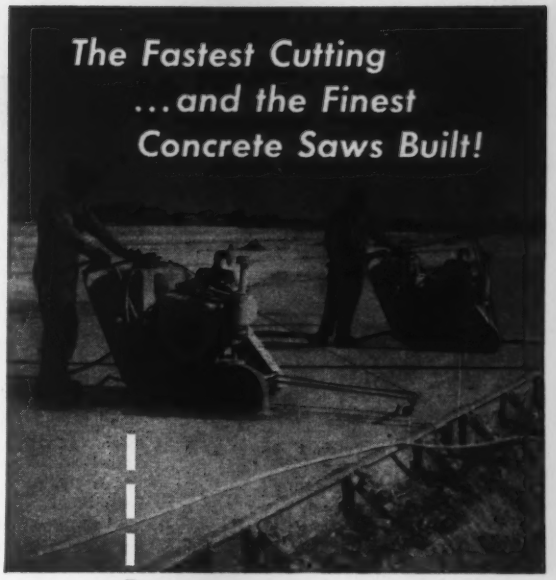
# From the MANUFACTURERS

**LIQUID OXYGEN PLANT:** Air Reduction Pacific Co., a division of Air Reduction Co., Inc., has begun construction of a new $3,000,000 liquid oxygen, nitrogen and argon plant in Richmond, Calif. The new plant, which will produce daily 30 tons of the liquid products, will largely serve the missiles, metalworking and steel industries in the San Francisco area . . . **MOVING OFFICES:** In an effort to streamline operations and cut down travel time to divisions, the Los Angeles Regional Advertising Dept. of U.S. Industries, Inc., is moving its offices from 5947 Sheila St., Los Angeles to 7701 Telegraph Rd., Montebello, Calif. . . . **SUBSIDIARY SOLD:** The Fluor Corp., Ltd., has sold its wholly-owned subsidiary, Midwest Metals, Inc., to Hydrometals, Inc. of New York City . . . **SALES DISTRICTS REGROUPED:** The eight eastern and western sales districts of Alpha Portland Cement Co., Easton, Pa., have been regrouped into divisions, and managers have been appointed for the newly-organized areas. Boston, Washington, New York and the eastern sales district will now comprise the eastern sales division. St. Louis, Chicago, Ironton, Ohio, and Birmingham sales districts have been combined to form the mid-western sales division . . . **COMPANY ADDS NEW LINES:** Brown Co. has added two new lines of polyethylene plastic pipe to its Bermico Div. Called "Bermico SD" and "Bronco," the new pipe will fill out the Bermico line, which includes bituminized fibre pipe for drainage and Bermico conduit for direct burial electrical wiring . . . **RETIREMENT ANNOUNCED:** The Union Metal Manufacturing Co., Canton, Ohio, has announced the retirement of C. A. Streb and W. A. Porterfield. Until their retirement they were respectively Chairman of the Board and Vice President in Charge of Sales Promotion . . . **NEW DIVISIONS:** Klemp International, a new division of the Klemp Metal Grating Corp., has been established to handle all aspects of Klemp's International-Foreign trade. The new division will be located at 1379 N. North Branch St., Chicago . . . As part of its 1959 expansion program, a new design, engineering and manufacturing division has been established in Canoga Park, Calif., by Hydromatics, Inc., Livingston, N. J., one of the foremost producers of precision Flo-Ball valves. The firm is involved in the design and manufacture of airborne and ground support Flo-Ball valves used in all major missile projects . . . **NEW SALES OFFICES:** A. C. Horn Companies announces the opening of new sales offices and warehouse facilities in Denver, Colorado; this is another step forward to keep pace with the rapid growth in the Rocky Mountain area . . . **ACQUIRED WORKING CONTROL:** Van Norman Industries, Inc. announces that it has acquired working control of the American Pully Co., in which it has held a minority interest for the last three years. **NEW SUBSIDIARY:** The formation of a new subsidiary company, Raymond International (U. K.), Ltd., London, England, has been announced by Raymond International Inc., New York City . . . **RECEIVES SAFETY AWARD:** The National Safety Council's highest industrial safety award, the Award of Honor, has been bestowed on Tractomotive Corp., Deerfield, Ill. . . . **DISTRIBUTORS APPOINTED:** Huber-Warco Co., Marion, Ohio, announces the appointment of The Fred Greenley Machinery Co. as a distributor of Huber-Warco Motor Graders, Tandem Rollers and Maintainers. They will represent Huber-Warco in the northeastern section of Pennsylvania . . . **NEW COMPANIES FORMED:** After a year and a half of successful operation as a division of Reade Mfg. Co., Jersey City, N. J., Thermex Metallurgical, Inc., will now carry on as a separate corporation, the Thermit welding business acquired by Reade from Metal Thermit Corp. in 1957 . . . A new company, Tretol, Inc., has been formed for the purpose of manufacturing and marketing a line of quality products for the concrete and masonry field . . . **APPOINTMENTS:** Mr. H. J. Longmore has been made Vice-President in Charge of Sales of Sprague & Henwood, Inc., Scranton, Pa. . . . The appointment of Mr. William L. Sammons as General Sales Manager of B-I-F Industries, Inc., Providence, Rhode Island, has been announced.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*Journals:* City Planning, Hydraulics, Irrigation, Power, Soil Mechanics, Waterways, Structural Engineering.

**2048. Urban Expressways: Joint Planning of Transportation and Land Use, by Roger L. Creighton. (CP)** Transportation systems and the activities of persons on land are both parts of human activity in cities. Joint planning is therefore essential, and a procedure for the joint planning of transportation and land use is described.

**2049. Cooperative Planning Urban Expressways: The Highway Engineer and the City Planner, by John S. Tsaguris. (CP)** This paper emphasizes the need for closer cooperation between highway engineers and city planners regarding the general character, extent and location of highway facilities through or near urban areas.

**2050. Cooperative Planning for Urban Expressways, by Fred W. Tuemmler. (CP)** It is proposed that highway and planning agencies establish a joint policy of continuous collaboration settling disagreements at staff level not in newspapers, accelerate urban planning programs in fringe areas to meet highway planning deadlines, and invoke acquisition of development rights.

**2051. Professional Registration of City Planners: Growth of City Planning, (CP)** This paper calls attention to the rapid growth of city planning and the need to insure that work to qualified professional planners. State registration is urged to give this protection to the public.

**2052. Professional Registration of City Planners: State Registration Laws by Paul H. Robbins (CP)** State registration laws are justified only when need is shown for protection of the public welfare. To justify registration, city planners have to identify the work done, establish the qualifications of this work and protect the public from the dangerous practices of those not qualified.

**2053. Professional Registration of City Planners: Foundations for Registration, by William H. Larkin. (CP)** City planners, to be recognized as a separate professional group, must base their claim upon a foundation of adequate education as well as professional experience. The initiative in registration must come from the city planners themselves.

**2054. Professional Registration for City Planners: Advantages of Registration, by E. Lawrence Chandler. (CP)** The seeming advantages of requiring legal registration of professional planners as a measure for protecting the public interest is recognized and some of the difficulties in such a program are presented.

**2055. Freeways in Urban Planning, by Harold M. Lewis. (CP)** The history and development of freeways as elements in urban and metropolitan plans will be reviewed in this paper. Coordinated transportation plans are suggested as urgent problems for the immediate future.

**2056. Ground-Water Problems in New York and New England, by Joseph E. Upson. (HY)** Ground-water problems in New York andf New England require a close evaluation of the occurrence and quality of water in the aquifers, an advanced knowledge of the hydraulics of ground-water movement, and the interrelationships of stream regimens.

**2057. Pressure Changes at Open Junctions, by William M. Sangster, Horace W. Wood, Ernest T. Smerdon, and Herbert G. Bossy. (HY)** This paper contains the results of an analytical and experimental investigation of the effects of open junctions on the magnitude of pressure changes in closed conduits flowing full.

**2058. Floods of the Florida Everglades, by Edwin W. Eden, Jr. (HY)** Large areas in central and southern Florida are subject to seasonal flooding. This paper examines floods in the Everglades area and the efforts involved in control.

**2059. Economic Evaluation of Water by P. H. McGauhey and Harry Erlich. (IR)** In this paper the problem of allocating unappropriated water to beneficial uses and thereby creating a greater economic yield, is studied.

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(SA) Sanitary Engineering
(SM) Soil Mechanics and Foundations
(ST) Structural
(SU) Surveying and Mapping
(WW) Waterways and Harbors
(PP) Professional Practice

**2060. Meteoric vs. Nonmeteoric Water, by H. E. Thomas and D. E. White. (IR)** As the demand has increased for surface water and ground water that is replenished by the hydrologic cycle, the possibilities of developing potable nonmeteoric water supplies has arisen. However, research indicates practically all juvenile water is too highly mineralized for most uses.

**2061. High-Lift Construction Methods for Mass Concrete, by Otto Holden. (PO)** The high-lift method of concrete placement has been applied successfully by Ontario Hydro since 1930 to a series of structures ranging in height to a maximum of 240 feet. All evidence indicates that dangerous cracking is unlikely in these structures.

**2062. Tractive Resistance of Cohesive Channels, by Irving S. Dunn. (SM)** A method of estimating the tractive resistance of cohesive channel beds is proposed. The method is based on information obtained from simple soil tests (Atterberg Limits, Particle Size Analysis, Vane Borer Tests).

**2063. Measurement of the Permeability of the Axially Anisotropic Soil, by Marinus Maasland and Don Kirkham. (SM)** The effect on piezometer measurements of an anisotropy in the horizontal plane is analyzed. Such an anisotropy does not significantly affect the numerical value of the shape factor of the piezometer cavity.

**2064. Analysis of Concrete Slabs on Ground, by G. A. Leonards and M. E. Harr. (SM)** A new theory is developed for calculating the stresses and deflections in concrete slabs of finite size supported on ground. The theory accounts for weight, superimposed loads, and warping due to temperature and moisture gradients.

**2065. Analysis of Haunched Octagonal Girder Space Frames, by Edward Y. W. Tsui. (ST)** An analytical procedure for the evaluation of stresses in haunched octagonal girder space frames is presented. The procedure is established, through generalization of the slope-deflection method.

**2066. Sand Bypassing at Santa Barbara, California, by R. L. Wiegel. (WW)** A breaker constructed at Santa Barbara, California interrupted the littoral drift of sand. Although costly, and not always satisfactory in all details, a method of dredging was developed to combat this function.

**2067. The Effect of Seiches at Conneaut Harbor, by Ira A. Hunt and Leonas Bajorunas. (WW)** Conneaut Harbor has a record of unusually frequent accidents. This paper analyzes seiches on Lake Erie and shows the correlation between water level fluctuation recorded at Buffalo and the accidents at Conneaut.

**2068. Subsidence Problem in Long Beach Harbor District, by R. F. Berbower. (WW)** Subsidence of the ground surface due to oil extraction has set a new record at Terminal Island, California. The history of this subsidence is given through studies determining casual, factors, resultant problems and solutions.

**2069. County Flood Control and Water Conservation, by Colonel C. T. Newton and Harold E. Hedger. (WW)** The extensive Los Angeles metropolis situated on a narrow and arid coastal belt receives occasional storms of high intensity. Problems of construction have been complicated due to the topography and heavy urban development.

**2070. Littoral Drift in Vicinity of Charleston Harbor, by James Neiheisel. (WW)** An integrated method employing wave refraction and sediment analysis is suggested as an approach to the interpretation of littoral drift characteristics fundamental to coastal engineering problems.

**2071. Model Study of Mooring Forces of Docked Ship, by R. L. Wiegel, R. A. Dilley and J. B. Williams. (WW)** Laboratory data are presented on the forces induced by water gravity waves in the camels and lines of a Liberty Ship moored alongside a dock for waves up to five feet in height and with periods up to one hundred and twenty seconds. (prototype dimensions).

**2072. Discussion of Proceedings Paper 1877. (CP)** John H. Matthews, John Alexander Logan on 1877.

**2073. Discussion of Proceedings Paper 1754, 1965. (IR)** Robert O. Thomas closure to 1754. Raphael G. Kazmann on 1965.

**2074. Discussion of Proceedings Paper 1672, 1675, 1683, 1864, 1946. (PO)** Arthur P. Geuss closure to 1672. P. L. Ailken corrections to discussion of 1675. L. A. Schmidt, Jr. closure to 1683. F. L. Lawton on 1846. R. T. Richards on 1946.

**2075. Discussion of Proceedings Paper 1509, 1696, 1865, 1867, 1878, 1879, 1909, 1914, 1940. (ST)** Panagiotis Moliotis closure to 1509. John E. Rinne on 1696. Frederick Norman Pannell on 1865. A. J. Francis on 1867. Aron Zaslavsky, W. W. L. Chan, Shaukat Miraz, Henry J. Cowan on 1878, Giuliano Augusti, Tullio Renzulli; Emilio Rosenblueth, A. A. Eremin on 1879. Robert F. Warner, Henry J. Cowan, Bela Goschy and George Balazs on 1909. John Sherman on 1914. David D. Brillenbourg Bravo, R. Schjoat on 1940. John A. Sbarounis and Michael P. Gaus corrections to 1940.

**2076. Discussion of Proceedings Paper 1663, 1833, 1834, 1859, 1890, 1997. (HY)** Elliot F. Childs closure to 1663. John B. Herbich on 1833. Francis T. Schafer on 1834 J. R. Bowman on 1859. Michele Viparelli on 1890. Bernard L. Golding on 1997.

**2077. Discussion of Proceedings Paper 1545, 1549, 1731, 1732, 1824, 1826, 1863, 1937. (SM)** Stanley J. Johnson closure to 1545. Fred H. Lippold closure to 1549. Thomas B. Kennedy closure to 1731. T. Cameron Kenney on 1732. Marcel Bitown on 1824. R. F. Legget on 1826. John A. Focht Jr., R. G. Brickell and A. W. Smith on 1863. T. Cameron Kenney, E. J. Zegarra on 1937.

**2078. Discussion of Proceedings Paper 1571, 1874. (WW)** J. T. O'Brien and D. I. Kuchenreuther closure to 1571. Williard M. Snyder on 1874.

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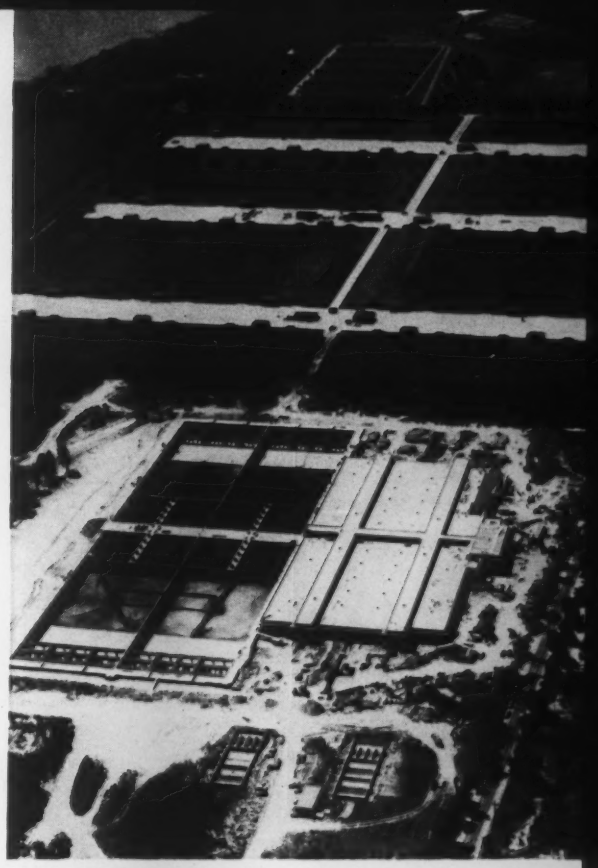

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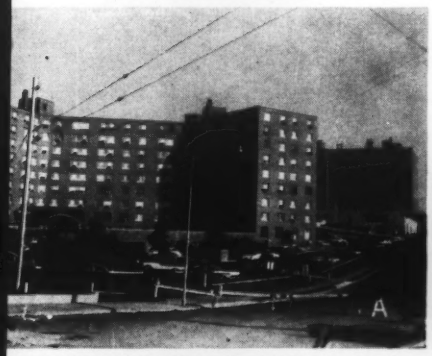

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